

# PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### Improvements in or relating to Bag Arrangements

I, CLARENCE WEDEKIND VOGT, a citizen of the United States of America, of Route 1, Norwalk, Connecticut, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

This invention relates to bag arrangements.

It is an object of the present invention to provide a plurality of individual bags connected into a series or chain to facilitate various bag filling operations such as supporting, advancing, opening, filling, closing and sealing of the bags. One of the objections to packaging in bags under present commercial practices is the manual handling required for individual bags. By the use of the present invention the amount of manual handling may be minimized. This results in substantial savings in the time and expense of packaging, and also permits packaging with greatly decreased possibility of contamination; such packaging is highly desirable in the packaging of foods and drugs for example.

A method of producing sealed bags is known, which comprises feeding superposed layers of heat-sealable packaging material, periodically applying heat and pressure upon opposite sides of the said layers of material to produce a chain of contiguous open-mouth bag pockets, moving the chain of open-mouth pockets along a horizontal path with the pockets opening upwardly, filling the said pockets with a commodity and subsequently applying heat and pressure to opposite sides of the said layers to seal the mouths of the pockets.

In accordance with the invention a bag arrangement is provided comprising a plurality of separate open-mouth bags interconnected by elements having coatings of

thermoplastic pressure-sensitive or self sticking means not forming an integral part of the bags at at least one point of each bag adjacent its open mouth and permitting the mouth of the bag to be opened when supported for filling.

In order that the invention may be fully understood, it will now be described with reference to the accompanying drawings, in which :

Fig. 1 is a plan view showing one way in which the bags may be made;

Fig. 2 is a section on the line 2-2 of Fig. 1, and on a larger scale;

Fig. 3 is a perspective view showing a plurality of pairs of connected bags, one pair of bags being in filling position and another pair shown as closed after being filled;

Fig. 4 is a section of a form somewhat similar to that shown in Fig. 3, but in which only one row of bags is connected in series;

Figs. 5 and 6 are perspective views of other forms;

Fig. 7 is a section through a further form, in which the bags lie endwise of the chain instead of crosswise;

Fig. 8 is a perspective view of a part of a chain of bags embodying the present invention;

Fig. 9 is a section on the line 9-9 of Fig. 8, but on a larger scale, and showing the top of the lower bag partially opened;

Fig. 10 is an enlarged sectional view through a modified form of chain in which two chains of single bags are connected together to permit successive advancing of a pair of bags;

Fig. 11 is an enlarged fragmentary perspective view of a bag adapted to be connected into a chain and provided with a handling element or member to facilitate control of the bag during advancement

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thereof to filling or closing or sealing apparatus;

Fig. 12 is a top plan of a chain of bags, those at the left hand end being collapsed 5 and those at the right hand end being fully opened;

Fig. 13 is a perspective view of a chain of bags where tapes are employed for sealing, without removal from the bags;

Fig. 14 is a view similar to Fig. 12, but showing the bags spaced apart when opened, rather than contiguous;

Fig. 15 is a perspective view of a chain of bags of a further type, and in which the 15 bags are lined and have infolded rather than outfolded side walls connecting the front and rear panels;

Fig. 16 is another perspective view of a fragment of a modified form of chain or 20 series of enwrappings;

Fig. 17 is a fragmentary perspective view of an enwrapment of the type shown in the chain illustrated in Fig. 16 to illustrate the closure of such an enwrapment;

Fig. 18 is a perspective view of a bag embodying the invention;

Fig. 19 is a top view showing a pair of bags of the type shown in Fig. 18, and connected by means of strips;

Fig. 20 is a top view of a collapsed tube with the strips attached, and which may be employed to form bags of the type shown in Fig. 18;

Fig. 21 is a view similar to a portion of 35 Fig. 18, but with the strips extending across both walls of the gussets;

Fig. 22 is a view of a portion of a sheet from which the bag shown in Fig. 21 may be made;

Fig. 23 is a view of a portion of a bag similar to that shown in Fig. 21, but with no adhesive on the lower portion of one surface of the strip, and none on the upper portion of the other surface;

Fig. 24 is a view similar to Fig. 22, but showing a different arrangement of strips;

Fig. 25 is a perspective view of the upper portion of a bag made from a sheet such as shown in Fig. 24;

Fig. 26 is a perspective view of a strip of the type shown in Figs. 24 and 25, and which is disposed inside of the mouth of the bag;

Fig. 27 is a perspective view of a strip 55 similar to that shown in Fig. 26, but for use on the outside of the mouth of the bag instead of the inside;

Fig. 28 is a view of the upper portion of the bag with the top folded over and sealed 60 down;

Figs. 29 and 30 are perspective views of tubing with strips attached, and showing how the gussets may be formed after attachment of the strips;

Fig. 31 is a perspective view of a chain 65 of flat bottom bags with strips on the upper and lower portions of the gussets;

Fig. 32 is a plan view of a sheet with strips attached, for making the bag;

Fig. 33 is a top view of a portion of a 70 chain of bags with successive bags opened to different degrees;

Fig. 34 is a perspective view of a portion of a series or chain of bags in accordance 75 with the invention;

Fig. 35 is a fragmentary perspective view of the top of a bag;

Fig. 36 is an enlarged section through the top portion of a closed and sealed bag to illustrate the completed closure; 80

Fig. 37 is a fragmentary perspective view of a portion of a modified form of bag embodying the present invention; and

Fig. 38 is a perspective view of a portion of a chain of enwrappings of the type shown 85 in Fig. 37 to illustrate their use in packaging.

In Figs. 1 and 2 there is shown one form of construction which may be employed. Strips 50, 51 and 52 may be 90 continuously fed from right to left, and open-ended tubes 53 are fed in any suitable manner to position them transversely of the strips, with the ends of the tubes coming midway of the edges of the strips 95 50 and 51, and with the strip 52 under the mid-portion of the tubes. All of the strips contain coatings of adhesive which is preferably of a delayed action thermoplastic type, and which has been activated in spots 100 or limited areas which will register with portions of the ends and mid-portions of the tubes. This activation may be by heat to render the heated area tacky and hold the bags in the desired predetermined positions 105 on the strips. The side strips are progressively folded over the ends of the tubes, pressed down, and heated to hermetically close the ends of the tubes. The tubes and the middle strip are pressed together to 110 cause them to firmly adhere in the activated areas, but not to seal together opposite walls of the tube mid-way between the ends. A cutter then operates to form a slit 54 separating the tubes into two bags 115 53a, closed and sealed at their outer ends, and to cut the middle strip 52 into strips 52a, each attached to the mouth portion of a separate row of bags. A fourth strip 55, preferably previously spot activated by 120 heat, is then applied over the slit and pressed on to cause the activated portions to adhere to the bags but not seal together opposite walls of the bags at their open ends. All of the strips may then be 125 severed between each successive pair of bags, as indicated at 56, to form pairs open at their adjacent ends but connected

together as a pair by the sections of the strip 55. If desired, the chain of bag pairs formed may be printed and/or rolled up in a coil for later filling, sealing and separation into single bags; or the chain may be separated as above into separate pairs for filling and sealing. For factory filling, the transverse cuts 56 may not be between each pair of bags of the chain, but between each series of for instance six or more pairs, so that all of the series of pairs may be supported on a suitable bar by the connecting strip 55, and simultaneously filled and sealed. After filling and sealing the bags then may be cut apart and sold as individual packages, or cut into pairs connected end to end, or into pairs connected side by side, or in other multiples.

In the construction shown in Fig. 3 there are provided a plurality of pairs of bags A and B, which may be sections of tubing of thermoplastic material, with the upper ends of the two bags A and B of each pair secured to opposite sides of a strip C which is bent along a centre line extending lengthwise thereof, to inverted V shape or U shape. Thus the bag pairs may be suspended or supported by placing this strip on a horizontal bar or other support 110 along which the bags may slide. This support 110 may be a travelling metal band which moves endwise to advance the pairs of bags from one position to another.

In carrying out the invention the V-shaped strip C which connects together the two bags of each pair is a long strip and connects the bag pairs in series to form a chain of bag pairs. Only three pairs of bags of such a chain are shown as connected to the strip C, but in commercial practice there might be a very large number of such bag pairs connected in series.

The bags are also connected in series by strips D substantially parallel to the strip C. The strips D are attached to the outer walls of the bags, and opposite to the walls which are attached to the strip C, and are disposed at or adjacent to the upper open ends of the bags. The bottoms of the bags may be free from each other, but are preferably connected in series. In the form shown in Fig. 3 the bag bodies have been formed of tubing, and a bottom strip E folded to U-shape and adhesively secured to the bag bottoms to close and seal the latter and to connect them in series. The bag bodies may be made of polyvinylidene chloride (known under the Registered Trade Mark "Saran"), and the strips may be made of paper coated with an adhesive which becomes tacky below the temperature at which the Saran will autogenously weld or seal.

In using the bag assembly shown in Fig.

3, the series of bag pairs are supported on the bar or other stationary or movable member 110, and are fed along in any suitable manner, preferably step by step in respect to the filling means. As shown, such filling means includes a pair of spouts or nozzles 111 which may lead from any suitable source of supply, with the usual control valves, measuring devices, etc. Such nozzles may have conical shaped ends or flanges or fins to facilitate the spreading open of the bag mouths. If desired, the nozzles may move downwardly into the bags before filling, and then up out of them to permit the next successive pair of bags to be brought to filling position.

In starting the operation, the pair of bags below the nozzles may be pulled open by hand, or in any other suitable manner. As the charge of liquid, powder, or material in other form is delivered into the pair of bags which are in filling position, such charge will further open up the bags. As the filling is taking place, the contents of the bags acts to further open up the bags, and as the outer walls of these bags are connected to the outer walls of the next successive pair of bags, this spreading apart of the outer walls of the pair being filled will act through the strips D to open up the upper ends of the next pair of bags. Thus, when a filled pair of bags is moved from beneath the nozzles, the next pair of bags will be brought beneath them and will have been automatically opened by the spreading apart of the strips D. Thus, the strips D serve as bag openers as well as bag advancing means, and they strengthen and reinforce the bag tops during and after filling, and insure against tearing of these seals and make the bags leak-proof and sift-proof.

Beyond the filling nozzles there may be provided a pair of rollers 112 which engage the outer surfaces of the strips D and press them toward each other and thus close the bags. The rollers may be heated, so that in closing the bags the heat is transmitted through the strips D and hermetically seals the bags, if the walls of the latter be of thermoplastic material. The rollers may be merely bag closers and sealers, and freely rotatable, in which case the strips may be pulled along solely by other rollers or by other pulling means beyond the rollers 112. If the rollers 112 be merely for closing and sealing, they may be replaced by non-rotatable heaters such as heated plates or shoes resiliently pressed toward each other and against the upper ends of the bags, to close and seal them.

The strips D may be connected to the bag walls by heat activated adhesive, so that when heat is applied to seal the bag mouths

this heat will soften the adhesive on the strips D and permit the strips to be pulled off from the bags, or permit the filled bags to slip down and away from said strips.

5 When heat activated adhesive is used on the strips D, the strips E need not connect the bottoms of the bags, or if they do, cutting means may be provided for severing such strips between successive bags.

10 Although it is preferable that the bags be connected in pairs, it is not essential to the invention in its broader aspect. In Fig. 4 I have shown how a single row of bags B<sup>1</sup> may be connected to strips D and C<sup>1</sup>,  
15 provided the last mentioned strip be of sufficiently stiff material so that the fold will not open up by the weight of the bag and its contents; or if the bag be supported primarily by a horizontal wall or shelf 113  
20 along which the bags may slide, or supported by a conveyor for supporting and carrying along the filled bags. In this figure I have shown the bottom of a bag closed by folding over the bottom end, as  
25 is common in bag constructions. Thus the connecting strip E shown in Fig. 3 need not be employed.

In the bag constructions above referred to, a strip C is employed which acts to support the bags. This is not essential. As  
30 shown in Fig. 5, the two bags A<sup>2</sup> and B<sup>2</sup> of each pair are connected together adjacent to their upper ends by a spot or small area F, preferably of self-sticking or latex  
35 type of adhesive. The two bags of each pair will rest upon opposite sides of a horizontal support such as the bar 110, and the pairs of bags are connected together in series by strips D. These strips may be  
40 attached to the outer walls of the bags adjacent to the open end by heat activated or self-sticking adhesive, and preferably in small areas G. In this form the bags are shown as made of thermoplastic material  
45 and the lower ends or bottoms closed by heat sealing along a narrow area H. It is not necessary that one pair of bags be connected to the other, other than by the strips D, but if desired, they may be con-  
50 nected adjacent to their lower ends by short strips K secured in place by adhesive, and readily removable.

The bags as shown in Fig. 5 may be closed and heat sealed after filling, in the  
55 same way as described in connection with Fig. 3, and the filling of one pair of bags will act to open up the next succeeding pair by reason of the connecting strips D.

In Figs. 3, 4 and 5, the strips D are  
60 employed for pulling the bag mouths open. In some constructions other means may be employed for opening the bags. In Fig. 6, I have shown bags in which comparatively stiff labels L are secured to the outer

walls of the bag and extend to some dis- 65  
tance above the open ends of the bags. In feeding the bags along, the upper edges of these labels may engage guides which will push the bag mouths open before they reach the filling nozzles. The bags when filled 70  
may be removed from the supporting strip C by applying heat to loosen the heat-activated adhesive, and the labels L may, if desired, be folded over the closed upper ends of the bags, although when the bags 75  
are formed of thermoplastic material they may be readily closed and sealed by applying heat and pressure to the outer surfaces of these labels.

In the various constructions hereinbefore 80  
described, the bag pairs are connected together in series, with the upper ends of each row of bags substantially in alignment. The bag pairs or single bags may be connected in endwise rather than edge- 85  
wise alignment. In Fig. 7 I have shown pairs of bags A<sup>4</sup> and B<sup>4</sup> connected together in pairs, and the successive pairs spaced apart endwise rather than edgewise. The two bags of each pair are preferably con- 90  
nected together by a spot seal near their open ends, and the bags can later be separated by peeling, the same as in Fig. 5, but the connecting strips D<sup>4</sup> extend lengthwise of the bags rather than transversely there- 95  
of.

The connecting strips D<sup>4</sup> may each be supported by a pair of rollers 114, the lower one of which may be heated. The rollers may be intermittently or continuously 100  
rotated to lift successive pairs of bags to the desired elevation where the pair of bags may be automatically pulled loose from the strips, deposited on a support such as the bar 110, filled and sealed. 105

The bags A<sup>4</sup> and B<sup>4</sup> need not be connected in pairs, as the bags may be in a single row on one strip D<sup>4</sup>, and they may have closure flaps. Thus, as each bag is raised to the proper point it may be filled, 110  
the flap closed, and the bag liberated from the strip by the pulling of the latter between the rollers, so that the filled and closed bags may fall into a receptacle or on to a conveyor. 115

Where two longitudinal tapes are used, they are preferably laterally offset, so that in rolling the chain of bags the strips are not superposed, and a firmer roll may be formed. The strip or strips may serve 120  
during the making of the bags to facilitate taking them from the bag machine, or to facilitate packing or rolling of a chain of the bags for shipment.

In Figs. 3 and 5 I have shown the strips 125  
A and D provided with perforations 115. These may serve to receive prongs or teeth of a feed means for pulling the tapes

and chains of bags along during or between filling, closing, and sealing operations, and if the tape sections are to be left on the bags, said holes provide weak points at 5 which the tapes or strips may be broken, cut, or easily torn in two.

In the construction shown in Fig. 8 the body portion 210 of each bag may be a section of tubing made from a material which 10 is impervious to moisture, or has been treated to render it impervious, and may be of thermoplastic, heat-sealable material. It, or its lining, may be of a heat-sealing "cellophane" (Registered Trade Mark), 15 such as made and sold by duPont, "pliofilm" (Registered Trade Mark) such as made and sold by Goodyear, films of a polyvinylidene made and sold by Dow Chemical Co. under the Registered Trade 20 Mark "Saran", polyethylene, such as sold by Plax Corporation and Visking Corporation, or other analogous material. The connecting members may be strips 211 of paper or other suitable sheet material. The 25 portion of each bag body which is to form the bottom thereof is sealed transversely in an area 212 to completely close the lower end of the tube.

The connecting members 211 are sheet 30 material coated with an adhesive which may be activated by heat or pressure. Each of the connecting strips or members 211 is a little longer than the width of a flat bag, and has one edge portion sealed 35 to the bottom end portion of the bag and preferably across the entire width thereof. It also has a small area 213 sealed to the upper portion of one wall of the next bag body at the open end thereof. Thus the 40 upper end of each bag may be readily opened out to facilitate filling and sealing without bending the strip. The lower edge portion of the strip 211 may be provided with short vertical slits 214 at 45 opposite ends of and extending from below the sealing area 213 to the lower edge, so as to form a short tab 215 which may be bent outwardly, as shown in Fig. 9, and rest on a supporting rail during the filling 50 of the bag. The chain of bags, as shown in Fig. 8, may be advanced step by step endwise and the several bags filled in succession.

The bags may be opened before filling by 55 the action of an air jet, the application of a suction nozzle, by a tab or in any other suitable manner.

After the filling of each bag the entire strip 211 may be disengaged from the 60 bottom of the filled bag and folded over the top of the next bag after the latter has been filled and closed, so as to seal the bag in closed position. Preferably, the strip is not removed from the bottom of a filled

bag but is cut in two along its length, as 65 shown by the dotted line in Fig. 8. Then one half is folded up over the bottom of one bag to reinforce the bottom, and the other half is folded over the closed mouth of the next bag to seal it. The strip 211 is pre- 70 ferably longer than the flat bag is wide, so that the end portions of the strip may be sealed together in folded form across the bag and also beyond the side edges of the bag, to better insure the hermetic sealing 75 of the bag.

In Fig. 8, the strip 211 is shown as having adhesive on substantially the entire area of one surface only. This is not 80 essential, as I may employ a strip having an adhesive coating on one surface of the strip on one side extending over only one-half of the area, and an adhesive coating on the opposite surface extending over the other half. Thus the strip is secured to 85 the front surface of the bottom portion of one bag and the back surface of the open end of the next bag. When the strip is cut in two in the middle the two portions may be folded around the ends of the bag in 90 opposite directions instead of in the same direction.

It will be noted that the strip 211 serves a double function in that it connects the bags together during the feeding of the 95 bags through the filling machine, and thereafter serves as a sealing flap to close and reinforce the ends of the bags.

If the bag be of the closed end type, reinforcement of the bottom is not as 100 important as it is in the tube form of bag shown in Fig. 8, and the entire strip may be folded over to close and seal the end of the bag below. As previously noted, the strips 211 may have printing thereon to 105 indicate the kind and quantity of the material in the bag, the name of the manufacturer of the product, the date of filling, etc., or it may be unprinted and the user may write or stamp the desired information 110 on the strip after the bags are filled and sealed.

The slits 214 shown in Fig. 8 may be omitted and the entire lower edge portion of the strip below the adhesive 213 may 115 be bent upwardly and form a bag support during filling.

In the case of individual bags bought for packaging, the usual commercial operations for filling the bags involve manually 120 handling the bags from stacks and manually presenting them to the filling apparatus or to a conveyor which passes adjacent the filling apparatus. By the use of the present invention the chains may be fed 125 directly to the filling apparatus with a minimum of expense and effort in handling the bags.

Fig. 10 illustrates a modified form of chain in which individual chains are combined by superposing one chain on another and connecting the bags of each chain together. Thus, pairs of bags may be simultaneously removed from the chain and thereafter handled until severance of the pair is desired. The pairs may be secured together in any suitable manner such as by providing portions of the bags to be paired with thermoplastic pressure sensitive or self sticking adhesive areas which may be placed in register and the bags adhered together. For this purpose a satisfactory adhesive would be the self-sticking type which will adhere to an area of the same substance but does not adhere to other surfaces.

A desirable form of connection is shown in Fig. 10 which discloses a plurality of bags 311 connected into a series by adhering top flaps 312 thereof to the adjacent bottom portions 313 of adjacent bags such as by the use of a thermoplastic, pressure-sensitive or self-sticking adhesive 314. An identical chain or series formed of bags 315 having their top flaps 316 connected to bottom portions 317 of adjacent bags by an adhesive 318 is placed alongside the previously mentioned chain or series of individual bags with bags of one chain superposed or in register with bags of the other chain. In this position adjacent bags of each series may be paired such as by the use of a tab or handling element 320. To illustrate, the upper margin of the tab 320 may have previously been connected to the bag 311 by an area of adhesive 321. The lower margin of the tab 320 may be coated with an adhesive 322 which may be a thermoplastic adhesive known as a "delayed action" type, that is, it can be activated by heat to tacky condition and permitted to cool prior to adherence. Thus the area of adhesive 322 may be activated prior to placing the bags 311 and 315 in registry so that when they are placed in registry they may be adhered merely by the application of pressure.

Between the two adhesive areas 321 and 322 the tab 320 preferably has an uncoated central portion 323 which will not be adhered to either bag. This uncoated portion 323 of the tab will serve as a link between adjacent chains and permits spacing of the connected bags. An advantage of this construction is to permit the insertion of handling fingers or other members useful in lifting or transferring the bags. Also, the pair of bags are adapted to be readily supported such as by resting the portion 323 on a horizontal rail of a conveyor or the like.

The members 320 may be made in any

desired manner but it is believed preferable to provide them with their end portions adhesively coated on opposite sides thereof with an intervening uncoated portion. Thus, the adhesive materials utilized at opposite ends of the tabs may have different characteristics so that, for example, activation of the adhesive at one end of the tab will not activate the adhesive at the other end of the tab. If a thermoplastic adhesive material is utilized to coat the opposite surfaces of the end portions of the tab these adhesives might be of such a nature that they will have different activation temperatures, one of which may be appreciably higher than the other.

Further, the tab portions may if desired, remain on the bag after filling, closing, or sealing, and in such event it may be desired to make the tabs of such a size that advertising matter can be imprinted thereon. Also, these tabs may be useful for handling the completed package or to facilitate displaying the package on a display rack. If it is desired to retain the tabs on the completed packages the tabs may be severed through the uncoated portions 323 in any suitable manner. It may also be desired to remove the tabs and when a thermoplastic adhesive material is utilized this can be readily done by heating the end portions of the tab to soften or reactivate the adhesive and then peeling or sliding the tabs from the bags. The tabs may also be detachably secured to the bags by a pressure sensitive adhesive having characteristics of high shear strength but which may be readily peeled.

Fig. 11 illustrates another modified form of chain. In this chain the individual bags or tubes, a portion of one of which is indicated by the numeral 325, are of the type in which a length of casing is cut along a straight line so that the sidewalls are of substantially equal length. The bottoms may be closed in any suitable manner. Individual bags may be connected together to form a chain by providing a thermoplastic, pressure-sensitive or self-sticking adhesive area indicated by the numeral 326 on the exterior surface of one sidewall of the bag, preferably near the mouth thereof so that the bag may be adhered to the bottom portion of an adjacent bag. When viewing Fig. 11 the area 326 is disposed on the exterior of the rear side wall of the bag or tube 325. As shown in the drawing the individual bags 325 in the chain may be provided with a member or handling element 327 for use in controlling the bag. For example, the chain may be fed to the filling position and the bags opened by gripping the handling element 327.

It is also contemplated that the provision

of the member 327 may facilitate handling of the bag to advance it either before or after it has been removed from the chain. As shown in Fig. 11 the handling element 5 327 comprises a tab member of the type shown in Fig. 10 in which one end portion 328 is adhered to the bag 325 and the opposite end portion 329 is provided with an adhesive area 330 on its outer surface, 10 the adhesive area 330 being on the surface of the tab 327 which is directed in an opposite direction from the surface adhered to the bag 325. Also, between the end portions 328 and 329 an intervening portion 15 331 is provided which is preferably not adhesively coated. To emphasize the fact that the portions 329 and 331 are not adhered to the bag or tube 325, the portion 331 is shown at a distinct angle to the bag 20 wall. Generally the portions of the member 327 will lie adjacent the bag wall extending only slightly outwardly therefrom in normal position.

The adhesive area 330 may be utilized to 25 facilitate gripping of the handling element or in the event the bag mouth is not provided with other sealing means the end portion 329 may be dimensioned and positioned so that it can be folded over the bag 30 mouth to act as a closure strip. If the member 327 is disposed below the bag mouth a suitable distance the walls of the bag mouth may be folded over and for packaging of many materials the use of the 35 member 327 as a sealing strip may be adequate. Obviously the member 327 may be of such size and shape that it will act as a label and completely enclose the top portion of the bag to provide an efficient 40 air-tight or sift-proof seal. For example, if the handling element extends for the full width of the bag or tube the end portion 329 when folded over the bag tube mouth and sealed against itself would provide a 45 sealed area completely surrounding the top and sides of the mouth.

While Figs. 10 and 11 show bags connected into chains by securing the mouth 50 end of one bag to the bottom portion of another bag while the bags are in end to end position it will be apparent that many other forms of chains can be provided. For example, it is contemplated that bags may be chained with their side edges overlapped 55 and secured together resulting in a chain which may be fed sideways with the mouths of all of the bags faced in the same direction. Further it is possible to secure the bags together with only portions of their 60 side edges overlapping or with only corner portions of the bags overlapping and secured to provide a chain in which individual bags will move along a line disposed diagonally with respect to the bags. It is

generally believed preferable to connect the 65 bags into chains in which the mouth ends of each bag face in substantially the same direction so that the chains may be advanced to a filling position and each bag mouth will be properly presented to the 70 filling nozzle.

Chains or series of bags made in accordance with the present invention may be assembled from any type of bag. The bags illustrated in Figs. 10 and 11 are of 75 the envelope type but it will be obvious that almost any other type of bag may be readily utilized. For example, in many instances it is desirable to use bags provided with infolds or pleats along their side 80 edges. This type of bag is desirable since it has the capacity of opening more fully where the nature of the contents to be enclosed make this desirable. Such bags may also be easier to open or control at 85 the filling station.

The embodiment of the invention shown in Figs. 10 and 11 may be readily applied to enwrapments or bags or tubes of heat 90 sealable material or having heat sealable liners or heat sealable material disposed around the interior of the bag mouths to permit sealing of the bags or tubes by autogenously welding or sealing the same.

Where bags are made of such a material, 95 handling members, tabs, labels or the like may be readily affixed thereto by the use of a thermoplastic adhesive having a lower activation temperature than that of the bag material so that applying or removing of 100 the handling members will not fuse or seal the bag wall. When bags or tubes of heat sealable material having a relatively low fusing temperature are utilized it is preferable to secure handling members and the 105 like with a delayed action type thermoplastic adhesive material since it has the property of remaining tacky after cooling below its activating temperature. Further, the use of a suitable pressure sensitive 110 adhesive may also be desirable to avoid adversely affecting the bag wall. Adhesives of this type are available with satisfactory adhering properties but which 115 may be readily peeled or removed without offsetting, marking or damaging the bag or tube.

In the forms illustrated in Fig. 12 the invention may be employed in connection with a known type of bag having a body 120 portion formed of a tube of sheet material with one end of both the front and back walls folded over as a flap and sealed to form the bottom of the bag, thus forming 125 a portion of four thicknesses.

In employing the invention in connection with this type of bag there are provided a pair of tapes 413 and 414 which may be

of paper or other suitable material, and each tape is coated on one surface with an adhesive which is of the self-stick or pressure-activated type, and which has high shear strength but can be easily peeled from the surface to which it may be attached. These two tapes are folded transversely to form accordion pleats, and each pleat extends around and encloses a vertical edge of the collapsed bag.

The tape may be positioned entirely below the upper open ends of the bags, or with its upper edge flush with or disposed below such ends. It may hold the bags in closely juxtaposed positions or spaced apart. If the bags are provided with flaps, these strips are preferably attached to the bags at or slightly below the opposite or shorter wall of the bags. Thus the flattened bags may be stacked with the tape extending in a short distance between successive bags, so that each bag adjacent to its open end will be formed of four layers, namely the two layers of a pleat of the tape and the two opposite walls of the bag, and the total thickness will thus substantially equal the total thickness of the bottom of the bag where the two walls are folded over to close the bottom 411 and provide four thicknesses.

The fold sections of the pleats of the tapes may each be of a length substantially equal to one-eighth of the perimeter of the bags, so that when the tapes are pulled out straight from the folded condition shown at the left hand end of Fig. 12 to the position shown at the right hand end of said figure, the bag mouths will be substantially square, with the side unpleated panels of the bags closely juxtaposed. By making the pleats of the tape shorter, the bags when open will be rectangular, but still closely juxtaposed.

In the filling of bags of the type shown, a stack of bags in collapsed form is delivered to the bag filling machine, and the ends of the tapes 413 and 414 are pulled to progressively open the bags, as shown at the middle portion of Fig. 12, and as the bags become filled the outer edge portions are pulled in to convert the bag to substantially rectangular form. After filling, the tapes may pass around rollers 415 and be pulled away from each other so that as each filled bag passes between the two rollers the tapes are pulled entirely free from the bags and may be re-used in making up a new chain. Thereafter the upper edge of the bag may be collapsed, and if the bags have a flap, this may be folded over to close the bag. The flap may have adhesive applied thereto, so that upon closing, the bag will be sealed. The bags may be closed and/or sealed in any other

suitable manner.

In the construction shown in Figs. 13 and 14, the bags 420 may be of the same type, but the tape employed for feeding the bags through the filling machine and for opening them up, may be employed as the means for sealing the open ends. The bags 420 at their open ends are connected together by tapes 421 which are folded to zigzag form, and one edge portion is sealed to the outer surface of the bag for a short distance in from each of the two opposite edges of the mouth of the collapsed bag. The tapes are of such length and of such width that a pleat 422 of the tape extends inwardly between adjacent bags without being sealed thereto, and the upper edges of the tapes are above the upper edges of the side walls of the bags, as shown in Fig. 13. In this form the walls of the bag need not be of heat-sealable material or be directly sealed together at the mouth.

When in stacked position the bags are flat, as shown at the left end portion of Fig. 14. Upon pulling the tapes the bags are separated from each other, and when the tapes are substantially straightened out, as shown at the right hand portion of Fig. 14, each open bag will be substantially rectangular in form at its upper end, and the bags will be spaced apart and may be readily filled. Thereafter, each tape is cut in two at a point midway between adjacent bags, and preferably at the inner end of each infolded pleat, and the mouth of the bag is collapsed to close it. The edge portions of the tapes which extend above the open end of the bag are then directly sealed together at opposite sides. The ends of one tape will preferably overlap those of the other, so that the bag is completely sealed by the portion of the tape above the end of the bag.

As a further embodiment of the invention shown in Fig. 15 I may employ bags enclosed in outer laminations or cartons. The bag 430, which may be of "pliofilm" (Registered Trade Mark), heat sealing "cellophane" (Registered Trade Mark), or other analogous material, is enclosed in a carton or outer casing 431 or lamination of stiff non-sealing material, and which is provided with slots 433 or cut-away portions through which the outer surfaces of the inner wall of the bag presented in the infolds may be sealed together, as well as to the side panels which latter are directly sealed together between the infolds.

In using double-walled bags of that type in carrying out the present invention, the bags are connected together by tapes 434 which have pleats extending into the infolds of the collapsed bags, and in the area where the inner lamination or bag proper



is exposed through slots or at cut-away portions of the outer lamination or carton. The tapes are secured to the inner lamination or bag proper by a type of thermoplastic, pressure-sensitive or self-sticking adhesive which permits the tapes to be readily pulled free. By pulling endwise on the tapes the infolded portions of the bag are pulled out from collapsed form, so that the bag presents a rectangular open end for filling. After the bags have been advanced by the tapes and have been filled, the tapes are pulled free from the bag, leaving the areas of the bag at the slots or openings 433 of the outer wall exposed, and the upper ends of the bags may be closed and sealed.

Various other types of bags may be employed, but as an essential feature there are employed the two tapes which act to open up the bags and advance them to and past the filling station, thereafter the bags being either closed and sealed by means of the tape remaining adhering to the inner bag or completely removed and the mouth of the bag heat-sealed in closed position.

In each of the forms illustrated in Figs. 12 to 15, each tape has adhesive on one surface only, is accordion pleated to form zigzag folds, and is secured to two wall portions of the bag which are integral or connected along a fold line. Thus, as the tapes are straightened or pulled toward a straight line, said wall portions come to or toward a single plane, and as a result the bag is opened for filling.

In the form shown in Fig. 13, additional means may be provided for further ensuring the tight sealing of the bag. A sheet of material may have approximately its upper third adhesively secured to one of the panels of the bag with an edge portion extending a quarter of an inch or thereabouts above the edge of the panel. The lower two-thirds will be free of the panel and adhesively coated on the outer surface. After filling the bag and closing the mouth thereof, this sheet of material may be folded up and over the bag mouth and secured to the opposite panel. The sheet may be of somewhat greater length than the width of the panel so that opposite portions of the sheet may be sealed together beyond the fold lines at the edges of the side walls of the bag.

Fig. 16 illustrates another chain or series of bags. In this instance the bags comprise lengths of seamless tubing 521 which may be provided with gussets or infolds along their side edges. An end portion of each of the lengths may be sealed in any suitable manner to provide a closed bottom for the bag. Where the tubing is formed from a heat sealable material the

bottom seal may be readily formed by autogenously welding the sidewall portions together. Such a seal is indicated by the numeral 522. The tubular bags may be connected together or chained by strips of sheet material 523 which may be folded along a line extending lengthwise of the strip so that the strip assumes an inverted U or V shaped configuration. A surface of the strip 523 may be coated with a suitable thermoplastic, pressure-sensitive or self-sticking adhesive material as indicated by the numeral 524 and the connection between the sidewall portions of adjacent bags may be made by activating areas of the strip 523 to cause adherence between the strip and the bags. The strips 523 are preferably of such a length that they extend beyond the sidewalls of the tubular bags.

After the bags have been filled they may be separated from the chain with one of the strips 523 still secured to a sidewall of each one of the bags. To seal the bag the strip 523 may be folded over the mouth of the bag and the adhesive coating thereon activated so that the two sides of the strip will adhere to the mouth portions of the bag. The portions of the strip 523 extending beyond the bag will adhere to themselves to provide a seal completely around the top and sides of the mouth of the bag. If, due to the contents of the package, it is desired to provide an especially tight or siftproof closure, the sidewalls of the bag at the mouth, if heat sealable, may be autogenously welded.

In Fig. 16 the strips 523 are shown as provided with a weakened portion or tear line along their longitudinal fold indicated by the numeral 525 in Fig. 16. This has been provided to obviate the necessity of activating the strips 523 to separate bags from the chain and also to avoid the folding over of the strips 523 for sealing the mouths of the bags.

The bags may be removed from the chain by severing the strips 523 along the line 525 so that half of each of the strips 523 remains adhered to each of the bags. Sealing of the bags may be readily accomplished by pressing the severed halves of the strips 523 together and heating them to activate the adhesive 524 thereon so that the halves will completely adhere together. As clearly shown in Fig. 17 this provides a seal completely around the sides and top of the mouth of the bag. Further if the bag walls are heat-sealable or have been coated on the interior of the mouth with a heat-sealable substance the walls at the mouth may be autogenously welded for additional tightness of the seal.

When the strips 523 are retained on the completed package and utilized to facilitate

sealing the bag, the exterior portions thereof may bear advertising material, or be used as a label to state the contents of the package, or provide instructions regarding its use, or other information.

An exceedingly desirable closure for many purposes may be made by sealing together the folded over portions or severed halves of the strips 523 without sealing together the walls of the bag at the mouth. Such a closure is readily openable by tearing or cutting the strips 523 along the edge of the bag mouth which facilitates access to the contents.

A further alternative closure may be provided by heating the connection between the strips 523 and one of the bags which it connects and folding the strip and the mouth of the bag over so that the strip 523 seals the bag mouth to a portion of a side wall of the bag.

As another alternative the forms of chains shown in Figs. 16 and 17 may be made so that the bags are provided with reinforcing strips or tabs secured to the wall portions of the gussets or infolds in the region of the mouth of the bag. These strips or tabs may be secured to the gusset walls in any suitable manner and if coated on their exterior surface with a thermoplastic adhesive, sealing of the bag mouth will adhere the wall portions of the gussets together which provides an excellent closure and siftproof seal. Also, the tabs or strips serve to reinforce the gusset walls and may be desired to provide an excellent pouring spout when packaging flowable material.

In Fig. 18 there is illustrated a type of bag formed of a section of tubing having infolded side walls 620, 620' constituting gussets connecting the side panels 621 and closed at the bottom by a transverse fold 622. The gussets are connected to the side panels along fold lines *a* and *c*, and midway between the side edges of each gusset is a fold line *b*. The walls are preferably of thin synthetic heat-sealable sheet material such as a heat-sealing "cellophane", "pliofilm", "Saran" (all Registered Trade Marks) and/or polyethylene. The bodies of the bags may be made from sheets of the type shown in Fig. 22 (the strip arrangement of which applies only to the construction of Fig. 21), with the edges heat-sealed together to form a tube, or they may be made of sections of seamless tubing of the type shown in Fig. 28.

Upon filling such a bag, the gussets are forced outwardly by the material, but in closing the mouth of the bag, the upper ends of the fold lines or creases *b* are pushed inwardly to re-form the gussets; but without the strips described below this

would normally result in the upper ends of these fold lines *b* being below the plane of the top edge of the side panels 621. Upon sealing the bag by heat and pressure, or by pasting a label over the mouth and on to the side panels, the bag may leak at the upper end of the fold line or crease *b*, and into the space between the gusset walls 620, 620'.

As one feature of my invention I provide strips which may be of stiffer sheet material, such as paper, and secure such strips to said sheet material in such positions that in forming the bag said strips are disposed in the gussets at the upper ends thereof, and act to reinforce and stiffen the upper edge portion of the gusset walls. They facilitate the holding of the upper ends of the fold lines at the same elevation as the upper edges of the side panels which said panels are being brought together in closing and sealing the bag. Thus the filled and sealed bag is siftproof. The strips preferably have adhesive on both surfaces thereof, and on at least those areas within the gussets. Before the closing of the bag the strips so formed and so secured to one wall of each gusset may spread apart, to facilitate filling. Upon closing the bag, the opposite surface of the strip is heat-sealed to the other gusset wall so that the upper portions of the gusset are sealed to the strips, and the gusset is stiffened.

In Fig. 18 I have shown a bag provided with a strip 623 which is of a length somewhat greater than the width of a gusset wall, so that one end of the strip is at the fold line *b* and the other end extends beyond the fold line *c* to form a tab 624. The strip is provided with adhesive on opposite surfaces of the portions of the strip within the gusset, so that after filling the bag and closing the mouth, the walls of the gusset are held in closed position. The adhesive on the portions of the strips which engage the gusset walls is of a heat-sensitive or heat-activated type, so that the sealing of the gussets in closed position and the sealing of the walls of the bag at the mouth may be effected simultaneously by the action of heat and pressure.

In forming a tube from the flat sheet, the positions of the fold lines *b* will be defined by one end of each strip, and the positions of the fold lines *c* will be determined by the end of the area of the strip directly secured to the sheet. The opposite end portion of the strip will extend beyond the fold line *c* to form the tab 624, which may be of any desired length. The tab serves many purposes. It provides a handle which may be used in holding the inner end of the strip and the upper end of the fold line *b* at the proper elevation during

the closing and sealing of the bag; it serves for connecting the bags together in pairs or chains during the feeding of the bags to and from a filling station; it may be moved sideways to pull the gussets outwardly to open the bag; it may serve to support the bags in upright position during filling; and it serves to hold the gussets closed when the bag mouth is closed. The adhesive on the surface of the tabs 624 may be a thermoplastic or an adhesive of the "self-stick" type, so that it will not be tacky and cause adherence of the tabs 624 until this is desired for chaining or other purposes. Such adhesive will readily permit peeling or separation of the tabs when this is desired.

In Fig. 19 I have shown two bags of the type shown in Fig. 18, and connected as a pair by sticking the ends of the tabs 624 of one bag to the ends of the tabs 624 of another bag. As the tabs are of stiffer material than the walls of the bags, the ends of the tabs which are sealed together may rest upon a pair of rails along which the bags may be moved to and from filling position.

The strips have a further function in that they may serve for opening the bags for filling. With the bags connected as shown in Fig. 19, it will be apparent that by pulling the bags away from each other from a flat or collapsed position, the gussets will be opened out and the side panels forced apart as the tabs swing on the fold lines at the bases of the tabs. The opening up of the gussets automatically spreads the side walls apart.

In Figs. 18 and 19 I have shown the strips secured to the gusset walls 620', but obviously one strip might be secured at one end to the wall 620' of one bag and at the other end to the wall 620 of the gusset of the next bag, and in this case the bags may be connected together as a chain, and in edge-on alignment, instead of being back to back.

Where a sheet rather than a seamless tube is used, the tabs are preferably applied in the proper positions along the length of a strip of sheet material, the width of the sheet being slightly greater than the desired circumference of the bag, to permit overlapping and sealing of the edges of the sheet to form a tube, or the edges of the sheet may be first sealed to make a tube, or seamless tubing may be used.

The strips may be attached to the tube with proper spacing along the length thereof, and with the tube collapsed as shown in Fig. 20, with the edges of the tube forming the fold lines *a* and *c* at opposite edges of the tube. One of the tabs will project beyond the edge of the tubing,

as shown at the left of Fig. 20, with one end of the strips defining the location of one fold line *b* when the gussets are formed. The other tab may be secured to the opposite wall of the tube and spaced inwardly from the edge to a distance equal to the width of the gusset wall 620, and with one end where the fold line *b* is to be formed. In opening up the tube the strips will define where the other fold will be formed, and one of the strips will be on the wall 620' of one gusset and the other strip will be on the wall 620' of the other gusset, as shown in Fig. 19.

In the construction shown in Figs. 18 to 20, inclusive, the strip is initially attached to only one wall of each gusset. Obviously the strips may be made as shown in Fig. 21, and of double length, with a fold line intermediate of the ends of the strip, so that the strip 623' will be initially secured to both walls of the gusset. In this form, the same as in the previous form, one surface of the body of the strip may be provided with heat-sensitive adhesive so as to become permanently attached to the walls 620 and 620' of the gusset, and one surface of the tabs may be provided with a type of adhesive which is activated by pressure and which permits ready peeling apart with or without the application of a relatively low heat. In all cases the strip is attached to the sheet material before the crease line *b* of the gusset is formed.

In Fig. 22 I have shown a sheet having strips 623' of the type illustrated in Fig. 21, and applied in two rows along the length of a sheet and spaced in each row in accordance with the length of the bag to be formed. Each strip is so positioned as to lie across the dot and dash lines *a*, *b* and *c*, which are to form the fold lines of the gussets. The portions of each strip between the lines *a* and *c* may be permanently attached by heat-sealing in these areas, or by an adhesive which when applied is cold, or at a sufficiently low temperature so as not to activate a thermoplastic coating on the bag or strip at an opposed or adjacent area. The end portions of the strips beyond the lines *a* and *c* may be left free of the sheet to form the tabs 624 having a thermoplastic, pressure-sensitive or self-sticking adhesive permitting joining to and peeling from the tab of an adjacent bag.

This sheet may have its edges brought together and sealed to form a tube, and the gussets formed between the two pairs of lines *a* and *c*, the positions of which will be defined by the ends of the sealed areas of the strips. The upper end of the bag will then be as shown in Fig. 21, with the ends of the strips forming tabs for connecting the bags together in pairs or in chains.

The strips may be scored intermediate of their ends, and on the surfaces away from the sheet, before being applied, and will thus accurately define the positions of the lines *b* when the sheet is folded to tubular form, and there will be firm and continuous sealing across these lines. The outer ends of the sealed areas on the strips will define the location of the lines *a* and *c*, and the width of the panel 621, that is, the distance between the two lines *c*.

The sheet may be cut transversely along the lines A-A, which are at the upper edge of each pair of strips, and the cutting may be before or after the opposite edges of the sheet are sealed together to form a tube. The bottom end of the tube may be closed in any suitable manner, as for instance by folding and sealing, as shown in Fig. 18, or by folding and sealing to form a flat bottom. Upon forming the bag as shown in Fig. 21, the ends of the strips may serve to connect the bags together in pairs or chains, as well as to hold the upper ends of the gussets flush with the upper edges of the panels while closing and sealing after filling.

If the bags are formed of seamless tubing, strips of the type shown in Fig. 21 may be applied to opposite surfaces of a flat collapsed tube. In such a flattened tube there are fold lines at opposite edges corresponding to the line *a* of one gusset and the line *c* of the other gusset, and the two tabs 624 which are superposed on the walls 621 are free from said walls.

In Fig. 23 I have shown a construction which is similar to that shown in Fig. 21, and which may be formed as in Fig. 22, but in this construction the adhesive 623b on the surface of the strip which contacts the gusset extends only about half way down the strip from the mouth of the bag, so that the lower edge of the strip will be free from the bag. The adhesive on the opposite surfaces which may be sealed together after the bag is closed, may cover only the lower section if the adhesive be of a type which cannot be readily applied to surfaces directly opposite to each other, or may cover the entire area if of other types. With the bag opened up for filling, the strips will extend in a straight line along the gusset sides of the bag, and the lower edges of the strips may be bent outwardly so that the bag may be supported by and moved along a pair of rails extending up into the space between the lower portion of the strips and the adjacent bag walls.

Where the strip is coated or otherwise treated with adhesive upon opposite surfaces, as in Figs. 21 and 23, the adhesive on one surface should be applied cold, or at a temperature sufficiently low not to activate other thermoplastic coatings or

areas of the bag, tubing or strip. 65

In the forms above described the strips or other elements are applied to the outer surfaces of the sheet material which forms the walls of the bag. In some cases it is desirable to apply the strips to the inner surfaces of said walls, one example of such a construction and method being shown in Figs. 24 and 26.

In Fig. 24 there is provided a strip having a centre section 630 of a length substantially equal to the width of one panel of the bag, and terminal sections 631 each of a length equal to the width of the gusseted walls. The strips may be applied to a sheet transversely thereof, as shown in Fig. 24, and positioned to extend from one fold line *a* to the other fold line *a* and thus across one panel and the sections which are to be infolded to form the gussets. The sheet is so folded as to bring the strip inside of the bag mouth, and the opposite edges are secured together to form a tube. The strip may be coated over the entire area of both surfaces with a suitable adhesive, but preferably the coating on one surface is on about one-third or one-half the width and along the entire length, and on the opposite surface is along the other portion of the width, as shown in Fig. 26. There may also be provided two other strips 632 on one side panel or in the gusset, and extending out beyond the fold lines *c*, and at a distance sufficiently below the mouth of the bag to leave a top portion of the bag above the strips 632. If desired, the strips may be secured to the walls 620 or the walls 620' of the gusset instead of to the panel, so that they will not appear on the top of the sealed bag, and if desired they may be at the mouth of the bag instead of a short distance below, as illustrated.

After the bag is filled the mouth portions of the bag may be pressed together. The top part of the bag may then be folded over, and the ends of the strips 632 are attached to the gusset walls of the bag. Preferably the top portion above the strips 632 is folded over through 180° along approximately the line of the lower edges of the strips 630 and then folded under a second time to lie in a horizontal plane along the top of the bag. The ends of the strips 632 are then secured to the gusset walls to complete the package, with a substantially flat top wall. In Fig. 28 I have not illustrated this folding under of the mouth of the bags, as that would prevent proper illustrating of the layers in the sealed mouth portion.

If the strips 632 are applied to a flat web as shown in Fig. 24, the adhesive on their free end portions is of a thermoplastic material to prevent the free ends from

adhering to the web. When it is desired to fold over the mouth of the bag and secure the strip 632 to the gusset walls, such adhesive may be activated and adherence obtained. Opening of the package may be readily accomplished by rupture or tearing of the strip 632 to free the bag mouth from the balance of the package.

By having the adhesive on the outer surface of the strip 630 along the upper half, and the adhesive on the inner surface of the strip on the lower half, the side walls at the mouth of the bag will not be sealed together at their extreme upper edges, and they may be slightly separated, and to an extent permitting one to grasp the opposite walls between the thumb and finger and pull loose the adhesive on the inner side of the strip, and open the bag.

In the form of the invention illustrated in Fig. 21, the strips are adhered to the gusset walls at the top of the bag and have tabs extending outwardly therefrom and positioned in line with the top edge of the bag mouth, but it will be obvious that they may be positioned at any desired distance downwardly therefrom. When the strips are positioned below the top edge of the bag mouth, they may be utilized to combine the functions of supporting and sealing together the gusset walls as well as the functions of the strips 632 shown in Figs. 24 to 28, namely, securing the bag mouth to the completed package. To accomplish this, the tabs 624 at one side of each bag may be longer than the tabs at the opposite bag side wall, and when the mouth is folded down on to the top of the package, the longer extending tabs may be adhered similar to the way shown in Fig. 28. Since the strip members are sealed to the gusset walls, both side walls of the bag are secured without the strip being on the outside top of the folded over bag mouth. Further, if it is desired that the strips not be disposed on the outside bag walls, due to their interference with printing or their effect on the appearance of the package, the positioning of the strip members in the gussets presents a satisfactory solution.

Fig. 27 illustrates another modified form of strip 630a similar to that shown in Fig. 26, except that it is adapted to be disposed around exterior portions of the bag in the region of the mouth. The inside surface of the strip 630a along the upper margins thereof is provided with a suitable adhesive material, 631a, to secure the strip 630a to the bag along one side panel thereof and along the gusset walls. The lower portions of the strip on the inside are shown as being uncoated so that they will not be secured to the bag walls and may be used for supporting the bag as it is being advanced similar

to the forms shown in Fig. 23. To permit the lower edge portions of the strips along the gusset walls to extend outwardly over rails or other supporting members, the strip may be slit transversely and upwardly from the lower edge at the ends of the middle section which engages the panel and to the strips of adhesive on the inner surface.

On the exterior portions of the strip 630a, the end sections thereof may be provided with a suitable adhesive of a thermoplastic material, to permit securing of the gusset walls together simultaneously with the sealing of the bag mouth. The central section of the strip may also be provided along the region of its lower exterior portion with a coating of a suitable thermoplastic adhesive and thus when the bag mouth has been closed and is ready for sealing, the lower portion of the central section may be folded over the top of the bag mouth and secured to the opposite side panel of the bag, similar to a saddle sealing strip. This may be beneficial where the bag mouth is not heat-sealable to provide a mouth closure for the bag. When the bag mouth is heat-sealable the use of the central section as a sealing strip may be desirable to increase the sift-proofness of the closure and to provide a stronger closure.

It has been previously pointed out that the strips should be attached to the sheet before the fold line *b* is formed therein. In Figs. 22 and 24 the strips are applied to flat sheets. In Figs. 29 and 30 I have illustrated how such strips may be attached to seamless tubing 640. The strips 623b are applied to the tube while the latter is inflated, and in two rows upon opposite sides of the tube. The strips in each row are spaced apart along the length of the tube to distances equal to the desired bag length. Such strips 623b may be of the type shown in Figs. 18, 21, 22 or 23, but are shown the same as in Fig. 23. The tubing with the strips as shown at the upper part of Fig. 30, and of any desired length, may be passed through suitable apparatus to form the infolded pleats. Preferably the infolding is done during the collapsing of the tube. For this purpose there may be provided gusset forming members such as rotary discs or plates 641 which have curved inner edges spaced apart to the desired distance between the inner fold lines of a bag, and the tube is so oriented that as it is moved endwise the portions of the tube wall bearing such strips are forced inwardly to form a collapsed tube having infolded pleats with the strips attached, as shown at the lower end of Fig. 30.

In some cases the tube may be merely

collapsed with the strips around the fold lines, and without infold pleats as shown in Fig. 29, and the strips 623b later reversely bent to form the infolded gussets. During the feeding of the tube endwise, and during the application of the strips, the tube may be supplied with air or other fluid to keep it inflated, and at the delivery end it may pass between rollers which hold the tube collapsed to prevent escape of the inflating fluid. It may then be fed to any suitable cutting mechanism to sub-divide it into bag sections, and to heating and/or pressing means to seal the bottoms of the bags.

In Figs. 31 to 33 there is illustrated another embodiment of the invention which is similar to the form shown in Fig. 21, except that attached elements are provided in the gussets at both the top and bottom portions of the bag and the bags are of the flat bottom type. A number of important advantages accrue from such constructions. The bags illustrated each have side panels 621 and infolded or gusset walls 620 and 620' as in the other bags above referred to, but the bags have a flat bottom 650.

In the packaging of light materials, it is difficult to properly fill bags, due to the fact that the bottom portion of the collapsed bag is folded up against one side panel and the opening of the gussets in the area of the bottom is constricted. Where a commodity is packaged in a bag formed of relatively stiff sheet material, or in multi-ply bags, this problem is rendered more acute. Conventional packaging practices now require that in preparation for filling, the bags be moved to one station where a former or mandrel is inserted into the bag for the purpose of adequately opening the gussets at the lower end and swing the bottom of the bag down into a horizontal plane. I have found that this operation may be eliminated by the use of properly positioned strips across the gusset walls in this bottom region of the bag.

As shown in Fig. 31, a chain or series of bags each having side panels 621 and infolded gussets having walls 620 and 620', is provided with strips 623. These are secured to the gusset walls in the region of the mouth, as shown in Fig. 21, but spaced a short distance therebelow. In addition, similar strips 623a are adhered to the gusset walls in the region of the bottom portion of the bag. The bags are shown in Figs. 31 and 33 as a part of a series or chain, and of the type known as "automatic" bags, which means that the bottom portion of the bag is fabricated in a manner to permit the formation of a flat bottom on which the bag may rest. These strips 623 and 623a are of the type which extend out-

wardly in both directions from the centre fold lines of the gussets. However, the strips are not provided with adhesive on their exterior surface to seal the gusset walls together, but are present to facilitate opening of the bag mouth and to facilitate detachably connecting the bags in a series so that they may be advanced to and from a filling station. It is therefore not required that the strips be adhered to the gussets along the complete width of the gusset wall. Preferably the two halves of the strip are of different lengths, which is desirable to facilitate chaining. Fig. 32 illustrates the strips in the form in which they are attached to the sheet material from which the bag is to be made, and it will be noted that the strips are secured to the gusset walls only in the areas adjacent the fold lines a and c.

The long half of the strip may be scored to provide a tab 624' which may be folded over upon the balance of the strip to facilitate a detachable connection between the strip and the strip of an adjacent bag. The opposite end or short end of the strip is provided at its end portion with a coating of a suitable thermoplastic adhesive which may be activated to tacky condition to permit adherence to the long end of the strip of the next adjacent bag. The connection of the strips with those of adjacent bags in the formation of a chain is illustrated best in Fig. 33, which illustrates such a chain in the process of opening.

It will be noted from Fig. 31 that the strips adhered to the gusset walls at the bottom portion of the bag are similar to those at the top portion of the bag so that they may be chained to facilitate the complete opening of the bag. While Fig. 31 illustrates the use of two strips, one disposed at the top of the bag and the other at the bottom of each of the gussets, it will be understood that additional similar strips may be used, or in some instances it may be desirable to utilize one strip extending for a substantial portion of the distance from the mouth to the bottom of the bag. To ensure adequate opening in the region of the bottom of the bag, the connection between the lowermost strip and the gusset walls should terminate near the bottom edge of the bag in its squared-up position.

As the bags are advanced towards filling position and it is desired to open them, the tabs of each gusset may be pulled to their straight line position as illustrated at the lower portion of Fig. 33, and due to the location of the strips, complete opening of the bag will be effected, as the bottom will be caused to swing from a position adjacent to one side panel to a horizontal position.

It will be apparent from Fig. 33 that due to the construction, a strong chain is provided, and one which will not have a tendency when pulled to peel the connections between adjacent bags, because such tensioning of the strips places a shear stress on the adhesive, thus taking advantage of the high shear strength normally possessed by the adhesive. It may also be noted that with the arrangement shown, the application of adhesive to the strips is simplified, since the adhesive is all applied to the same surface of the strip in its flat condition.

Ordinarily it is desirable to remove the strips from the gusset walls when they have accomplished their purpose of opening the bag, if their presence on the completed package may be considered objectionable, and after removal the strips may be re-used.

Preferably the thermoplastic, pressure-sensitive or self-sticking adhesive on the tabs or extensions of the strips in the areas 623e is of a different character than that in the areas 623d connecting the strips to the gusset walls, and the latter adhesive is of a type permitting the peeling of the strips from the bags. The bags may be advanced in succession to a filling station and automatically opened by pulling on the strips. Preferably the ends of the strips are attached to and wound up on reels 651 so that after each filled bag passes the filling station, the strips are pulled loose from the bags and wound up. Such pulling and winding peels the strips loose at the sealed areas 623d, but does not disconnect each strip from the next one at the sealing area 623e because there is no peeling stress exerted in these latter areas. The connected strips may be unrolled later and utilized in making another chain of bags.

In some cases the strips may be made of a transparent material and attached by a substantially transparent adhesive, so that the strips may be left on the bags but will not be noticeable.

Figs. 34 to 36 illustrate bags of the type known commercially as automatic bags. In this form of bag there are opposed side panels 701 and 702, the marginal edges of which are connected by infolds or gusset walls 703. The bottom seal of the bag indicated is constructed so that when the bag is opened it will have a flat bottom and is adapted to stand by itself. Such bags are conventionally fabricated from a continuous web of sheet material, the sheet material being formed to tubular configuration with the infolds or gusset walls provided therein and the marginal edges of the web of sheet material being overlapped and adhered together along a longitudinal seam

705. At the desired predetermined interval 65 the tubular configuration is severed and the individual bags are completed by the formation of a bottom seal.

The mouth end of the bag is provided with one or more elements or tabs 706 to facilitate connection of the bag into a series or chain and to facilitate opening of the bag mouth in order to place commodities therein during packaging. In the form of the invention shown in Figure 34 the tabs or elements 706 have been struck from a portion of the gusset walls and a pair of such tabs have been provided, formed from each of the gusset walls. These tabs are adapted to be folded or hinged at approximately the intersection of the side panel 701 with the gusset walls 703 and may be bent so as to extend outwardly from the side panel 701. Desirably, the tab portions may be coated with suitable adhesive material indicated by the numeral 707 and the tabs may be adhered to a portion of the next adjacent bag in the series.

As shown in Fig. 34 the tabs may be adhered to the gusset walls 703 of the next adjacent bag and it may be seen that the length of the tabs is such that they do not extend for the full distance of the gusset walls. In this way the tab portions may be secured to the next adjacent bag, adjacent the mouth thereof, so that all of the bags in the series may have their mouths in substantially the same plane. Fig. 34 illustrates that when a series of bags are connected together in this fashion, tension placed on a leading bag in the series will cause it to open and in addition will cause a progressive opening of the succeeding bags in the series, as well as facilitate their advancement to a position where it is desired to fill them.

In the case of bags of the automatic type it may be desirable to completely open the bag for filling and this may be accomplished by connecting together lower portions of the bags.

The tabs or elements 706 may be fabricated from the sheet material of which the bag is made while it is in the form of a flat web or during formation of the web to tubular configuration. Preferably in fabricating the tabs or elements 706 rounded corner portions should be formed and particularly at the junction of the tab or element with the side panel to increase the strength of the connection between these parts.

The thermoplastic, pressure-sensitive or self-sticking adhesive coating 707 may also be applied to the web of sheet material prior to the formation of the bag. To provide a closure which will be secure and siftproof,

additional adhesive material 708 may be applied to the balance of the bag wall portions, partially or completely surrounding the mouth of the bag. If the adhesive is to be applied completely around the mouth of the bag it may comprise a stripe extending transversely of the web of sheet material and completely thereacross. The adhesive should be applied to that side of the web which will become the outer surface of the bag and thus the adhesive areas 707 on the tabs and the adhesive areas 708 on the balance of the bag walls may be simultaneously applied.

It is believed preferable to utilize an adhesive of a type which may be reactivated so that the same adhesive material may be re-used to seal the bag mouth after it has been used in chaining the bags. Such adhesives may be thermoplastic in nature and will be activated to tacky condition by the application of heat. Adhesives of this type are available and may be readily applied to a web of sheet material in any suitable manner such as by printing. When dried, the web may be handled in its customary manner and since the adhesive is not tacky until heat activated it will not interfere with formation of the bags. When it is desired to connect the bags into a series or chain, any portion of the adhesive 707 on the tabs or elements 706 may be activated to tacky condition and the tabs adhered to portions of the adjacent bag to obtain the chain or series illustrated in Fig. 34.

When it is desired to separate the bags from the series or chain which will usually be at the time of filling, or thereafter, the adhering portion of the tab 706 may have its adhesive coating 707 activated and the tab may be readily peeled or separated from the adjacent bag. At this point the adhesive areas 707 and 708 may be utilized to effect an excellent closure for the filled bag. The adhesive areas 707 and 708 may be activated to tacky condition and the tabs or elements 706 folded around the ends of the bag and on to the surface of the side panel 702 as shown in Fig. 35. Since the side panel 702 has a coating of adhesive 708 around the top of the mouth of the bag the tabs 706 will readily adhere thereto with their adhesive faces 707 facing outwardly. Further, the portions of the adhesive area 708 on the gusset walls 703 will cause these gusset walls to be securely adhered together providing a siftproof closure at these portions of the bag mouth (see Fig. 35). If the mouth portion of the bag is folded over approximately on a line extending along the bottom of the adhesive area 708 and the bottom portion of the tabs 706, the mouth portions of the bag will adhere to the side

panel 702 of the bag on to which they have been folded. A second fold of these top portions of the bag, which results in a closure sometimes referred to as a confectioner's fold, brings the adhesive portion 708 along the side panel 701 into contact with the opposite side panel 702 of the bag to provide the closure illustrated in Fig. 36. If desired, the bag wall 702 may be provided with an additional strip of adhesive 709 at the point where it is to receive the folded over portions of the bag mouth to ensure holding such sealed portions of the bag wall. The adhesive area 709 may best be seen in Fig. 35. As may be seen in Fig. 36 the closure thus provided results in a relatively flat top for the package which permits stacking of completed packages on top of each other.

Obviously, many other forms of closure may be utilized. In some instances it may be desirable to adhesively coat only the tab elements and then to remove the tabs by cutting or tearing them off when effecting closure of the bag mouth.

Figs. 37 and 38 illustrate a modified form of the invention which is applied to bags of the infolded or gusset type. Each bag comprises a pair of opposed side panels 711, the marginal edges of which are connected by infolds or gusset walls 712. In the region of the top portion of the bag each of the gusset walls has been cut to form oppositely extending tabs or elements 713 and 714 which tabs may be bent to extend outwardly from the side panels 711 to facilitate their connection to tabs or elements of adjacent bags as shown in Fig. 38.

Each of the bags may be provided with a thermoplastic, pressure-sensitive or self-sticking adhesive stripe 715 extending completely around the mouth portion of the bag and in this way the tab elements 713 and 714 will be provided with an adhesive coating to permit adherence therebetween. As previously described, in connection with the form of invention shown in Figs. 34 to 36, the opening of a leading bag in the chain will cause a progressive opening of succeeding bags in the chain so that as the bags are advanced to filling position the bag mouths will be opened. By utilizing an adhesive which may be reactivated, the tab portions can be readily separated to remove the bags from the chain when desired.

Closure of the filled bags may be effected by bringing the two side panels 711 together. The tabs 713 which are longer than the tabs 714 are then folded through degrees and brought forwardly against the tabs 714, and then on until they adhere against the adhesive 715 on the front flap



711. The combined layers are then folded down against the body, involving movement of about 180 degrees. They are folded again until the adhesive on the rear face of the rear side 711 engages the front face of the front side 711. If the bag is filled, this will be a fold of about 90 degrees. Variations in the chain may be produced by connecting the tab elements of adjacent bags in other manners. For example, the spacing between adjacent bags in a chain may be determined by the amount of overlap of the tab elements of adjacent bags. Such spacing can be controlled to meet the requirements of the particular filling apparatus which is to be utilized to place commodities into the bags.

It may also be noted that in the form of invention illustrated in Figs. 37 and 38, that the provision of the integral tabs 713 and 714 does not affect the fabrication of the bags by conventional bag machinery, and does not require the use of additional materials to obtain the chaining means. Further, the bags may be closed and sealed so that the tab elements 713 and 714 will not be apparent and thus cannot be said to detract from the appearance of the completed package after the function in chaining the bags and opening the bag mouths has been fulfilled.

While for purposes of simplicity the drawings illustrate bags of only a single wall thickness, it is contemplated that the present invention may be applied to bags formed of laminated sheet material with an inner layer of heat sealable material having opposed side panels and connecting infolded or gusseted side or edge walls. The outer lamina or layer comprises opposed side panels and connecting edge or side walls fabricated of a non-fusible and protective material. Such bags are provided with an open end or mouth at one terminal edge of the opposed side panels.

As is shown in Fig. 37 tab elements may be struck from an outer protective layer of the laminated sheet material to permit chaining of the bags as illustrated in Fig. 38. The formation of the tab elements may provide windows or cut-away portions in the outer protective layer extending partially or completely along the infolded or gusseted walls of the bag. Thus, when the bag mouth is heat sealed the inner fusible layer of the laminated sheet material may be autogenously welded, partially or completely, across the bag mouth. The infolded side walls of the fusible material are securely adhered to each other and to the portions of the side panels which extend in overlapped relation with the infolded walls. The removal of the outer layer of protective material in

these areas permits this sealing of the gusset walls and facilitates heat sealing of the mouth of the bag.

The portions of the opposed side panels between the gusset walls on the complete bag mouth may be left unsealed for filling purposes. Closure of such a construction may be effected by sealing uniformly across the bag mouth throughout the gusseted walls and the side panels, or by sealing over varying areas across the bag mouth.

The present invention may, therefore, not only effect the formation of tab elements to facilitate connecting bags into pairs, series or chains but simultaneously causes exposure of the gusset walls of the inner heat sealable layer of laminated sheet material which facilitates the making of an especially secure and siftproof seal across the mouth portion of the bag.

It may be seen that the embodiment of the present invention illustrated in Figs. 34 to 38 provides a bag construction in which elements are formed to extend outwardly from the bag and permit securing the bag to another bag or bags to facilitate the use of such bags for packaging. The elements may be formed from portions of present conventional bag designs without affecting the use of such bags and without requiring appreciable deviation from present commercial bag making machinery. Such bags may also be readily provided with means to improve their use, such as the formation of improved closures, and the like.

The bags may be connected together in a variety of ways to permit their advancement in the desired direction as well as with the desired spacing. These factors may be determined according to the dictates of the filling mechanism, the commodity to be packaged, the type of closure, and other like considerations.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A bag arrangement comprising a plurality of separate open mouth bags interconnected by elements having coatings of thermoplastic, pressure-sensitive or self-sticking adhesive means not forming an integral part of the bags at at least one point of each bag adjacent its open mouth and permitting the mouth of the bag to be opened when supported for filling.

2. A bag arrangement according to claim 1, comprising a pair of individual bags having adhesive connecting means joining together top portions of the bags in such fashion as to cause the bags to open when supported for filling whereby said bags may be supported during bag fill-

ing operations with the ends open to facilitate the filling operation.

3. A bag arrangement according to claim 2, in which the bags are adapted to be suspended by said connecting means on opposite sides of a support with their open ends facing upwardly.

4. A bag arrangement according to claim 2 or 3, in which the bags have multiply walls, a ply of one bag being connected to a ply of the other bag along a portion only of their open ends.

5. A bag arrangement according to any of claims 2 to 4, including means attached to the opposite outer walls of said bags for facilitating opening thereof when said bags are supported by the connecting means therebetween.

6. A bag arrangement comprising a plurality of pairs of bags according to any of claims 2 to 5 connected together in sequence by a strip secured to at least one bag of each pair.

7. A bag arrangement according to claim 1, comprising a plurality of individual bags having portions at their open ends connected via an adhesive connection to a strip of material along the length thereof, said strip being adapted to be bent lengthwise thereof to form an inverted V, whereby said bags may be supported during bag filling operations.

8. A bag arrangement according to claim 7, including means independent of said strip for connecting each bag to an adjacent bag.

9. A bag arrangement according to claim 1, comprising a plurality of individual bags having adhesive connecting means joining together similar side panels of adjacent bags whereby said bags may be advanced in sequence and supported to facilitate bag filling operation.

10. A bag arrangement according to claim 9, in which said connecting means comprises elongated strips disposed parallel to the longitudinal axis of said bags.

11. A bag arrangement according to claim 9, in which said connecting means comprises elongated strips disposed at an angle to the longitudinal axis of said bags.

12. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in sequence by a pair of strips having an adhesive connection to opposite side walls, said strips serving to support said bags during filling and to facilitate bag filling operations.

13. A bag arrangement according to claim 1, comprising a plurality of individual bags detachably connected in sequence, each bag having a bottom portion connected to the open end of the next bag by a separate strip of thermoplastic,

pressure-sensitive or self-sticking adhesive sheet material to facilitate bag filling operations.

14. A bag arrangement according to claim 13, in which at least a portion of each strip is adapted to be folded over to close and seal one or other or both of the adjacent bag ends after filling of the bags.

15. A bag arrangement according to claim 14, in which the intermediate portion of the strip is separable into two parts to close the open end of one bag and to reinforce the bottom of the adjacent bag.

16. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in sequence with portions of adjacent bags in overlapped relation and detachably adhered to facilitate bag filling operations.

17. A bag arrangement according to claim 16, in which each bag has one of its side panels extending beyond its opposite side panel in the region of the bag mouth to form a closing flap having thermoplastic, pressure-sensitive or self-sticking adhesive material thereon, the bags being arranged in a series with the mouth portions facing in the same direction with a bottom portion of each bag overlapping and adhered to the flap of the adjacent bag.

18. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in sequence with the flat side walls of each bag contiguous to and registering with those of adjacent bags and thermoplastic, pressure-sensitive or self-sticking adhesive strips folded to zig-zag form with portions of each strip connected to each bag adjacent the open end thereof, to facilitate bag filling operations.

19. A bag arrangement according to claim 18, in which the side walls of each bag have infolded connecting walls, said zig-zag strips having portions entering into and attached to said infolded connecting walls.

20. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in series with a side wall portion of each bag connected with a side wall portion of an adjacent bag, to facilitate bag filling operations.

21. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in sequence, each bag having side panels and connected infolded gussets with a strip of adhesive material adhered to at least a portion of an infolded gusset wall prior to the formation of said infolded gusset wall, to facilitate bag filling operation.

22. A bag arrangement according to claim 21, in which said strip of adhesive material is disposed along the infolded

gussets of said bags in the region of the bottom of the bags to facilitate full opening of said bags.

23. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in sequence, each bag having side panels and connecting infolded gussets with a strip of thermoplastic, pressure-sensitive or self-sticking adhesive material extending along a surface of at least one wall thereof at the mouth of the bag and having a tab portion or stiffening element adhesively adhered to an adjacent bag, to facilitate bag filling operations.

24. A bag arrangement according to claim 23, in which said tab portion is connected to the tab portion or stiffening element of an adjacent bag.

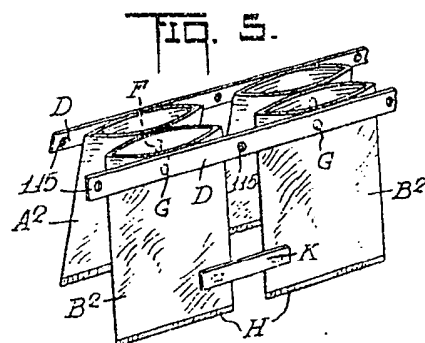
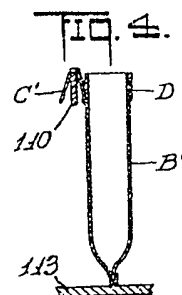
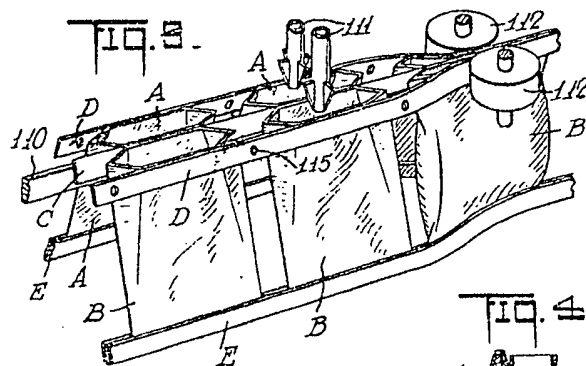
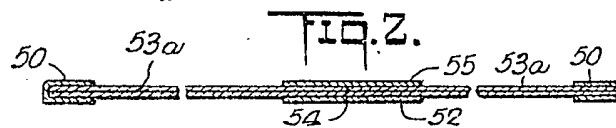
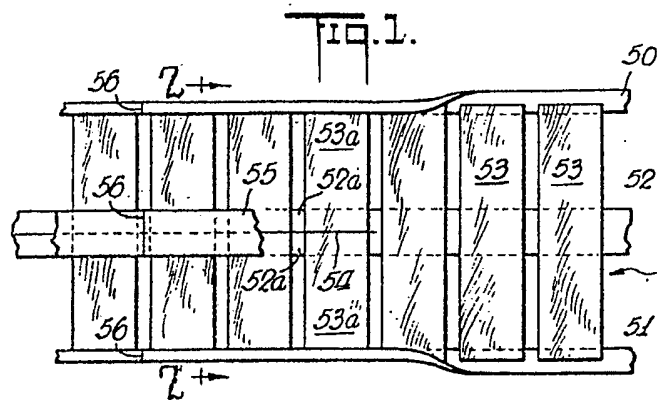
25. A bag arrangement according to any of claims 21 to 24, in which said strip has adhesive on opposite surfaces thereof for holding the gussets closed when desired.

26. A bag arrangement according to claim 1, comprising a plurality of individual bags connected in sequence, each bag having elements formed from wall portions thereof in the region of the mouth of the bag and adhesively connected to an adjacent bag, to facilitate bag filling operations.

27. A bag arrangement according to claim 26, in which each bag has side panels and edge walls, with one or more tab elements struck from each of said edge walls and extending outwardly with overlapping engagement with edge walls or tab elements of the adjacent bag.

28. Bag arrangements substantially as hereinbefore described and as illustrated in the accompanying drawings.

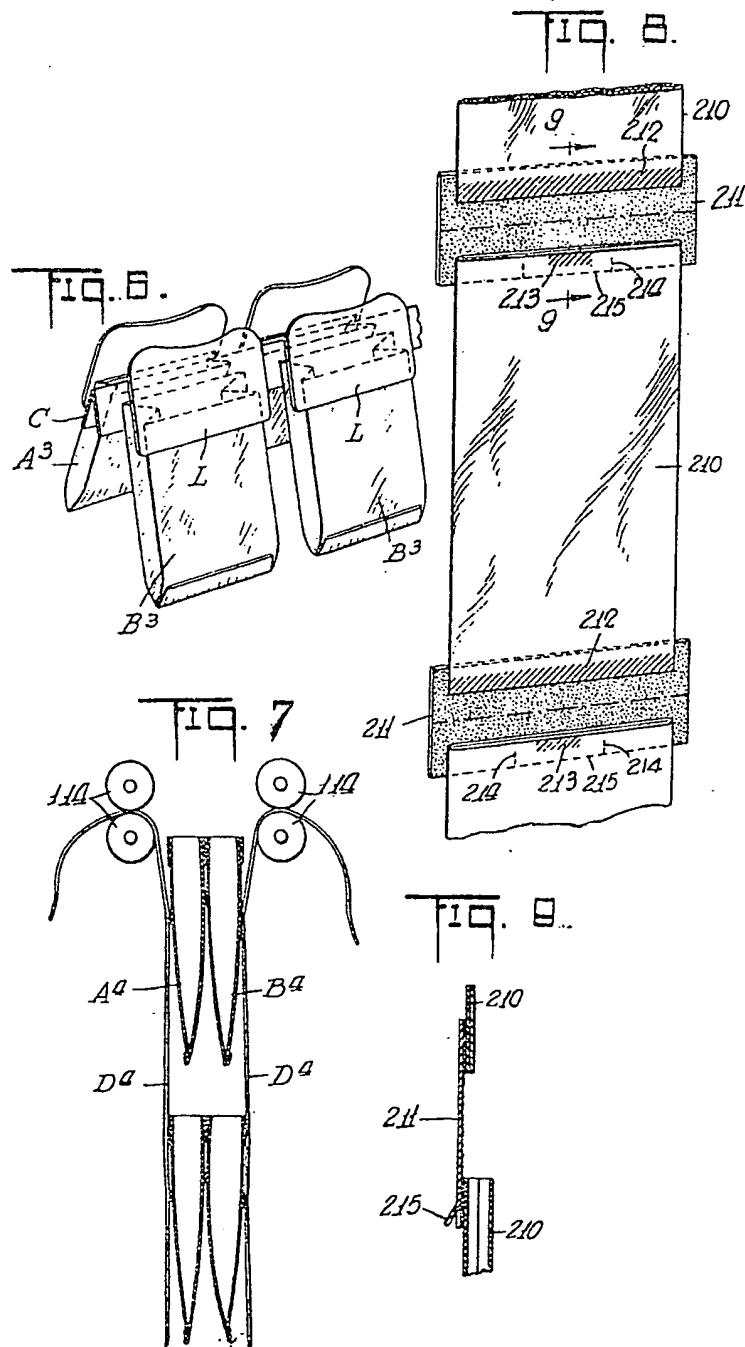
STEVENS, LANGNER, PARRY &  
ROLLINSON,  
Chartered Patent Agents,  
Agents for the Applicant.

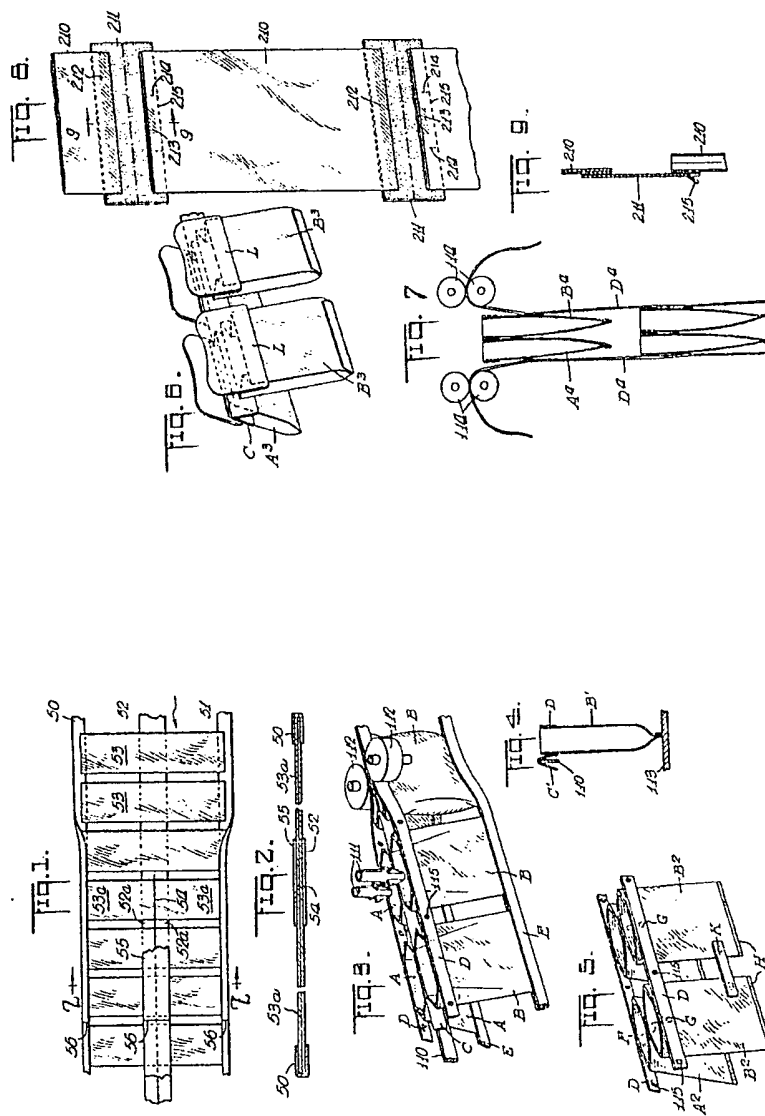


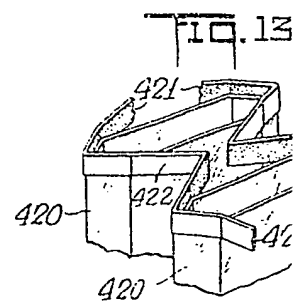
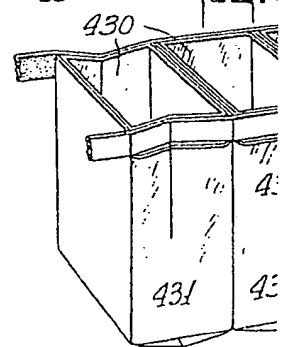
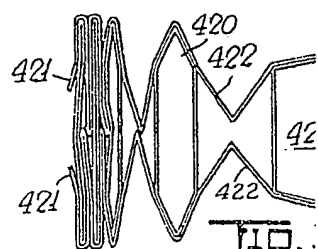
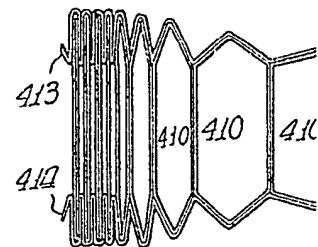
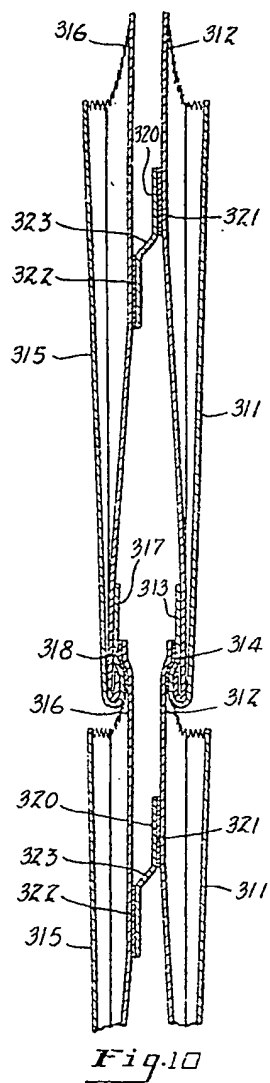
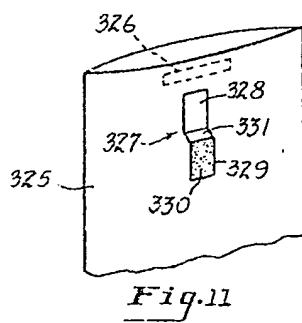
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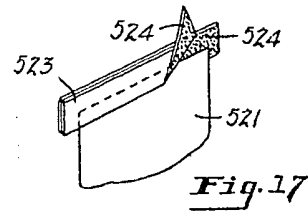
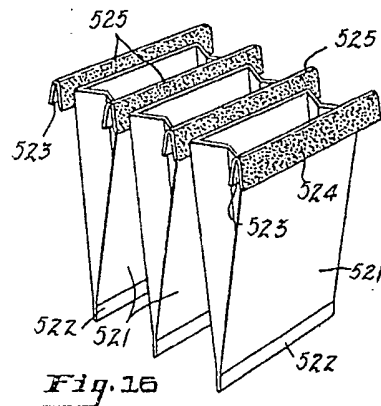
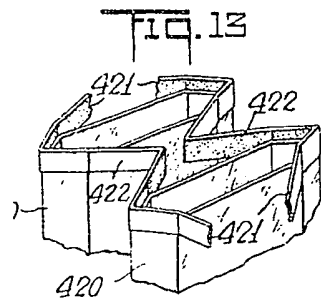
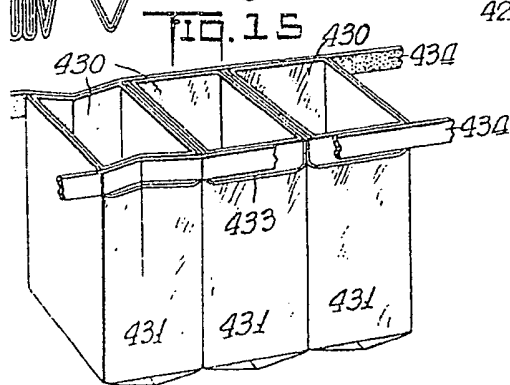
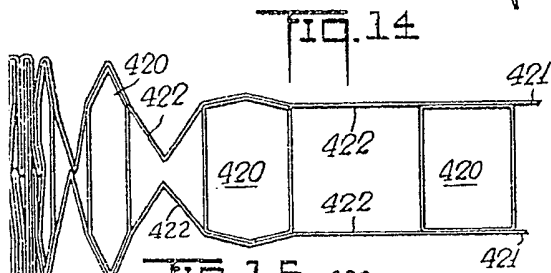
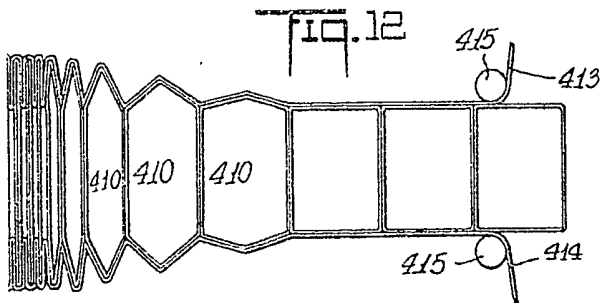
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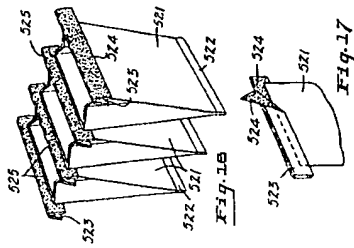
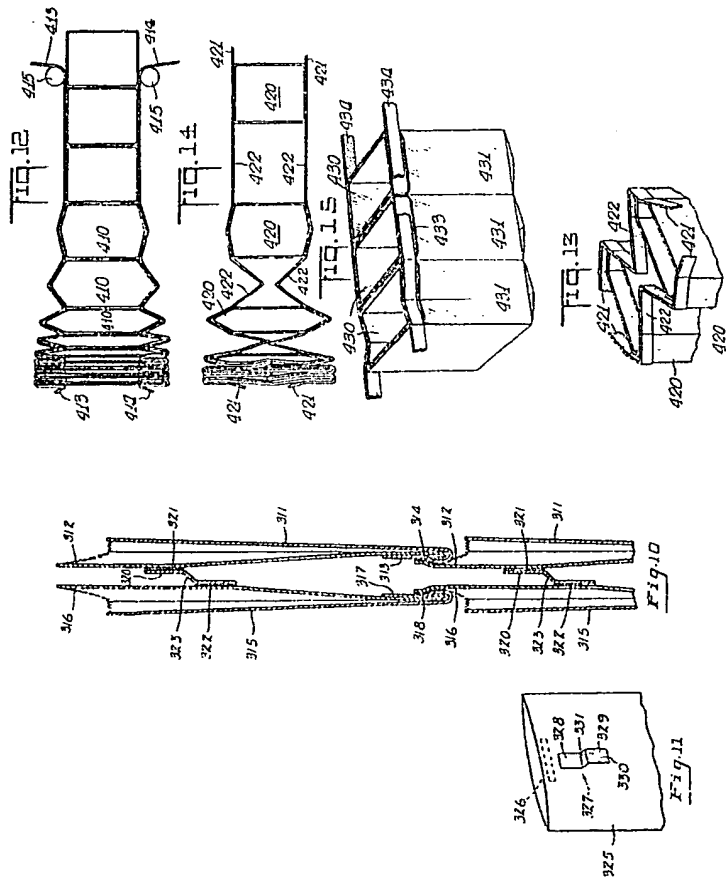








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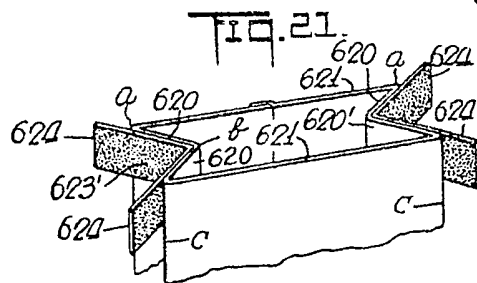
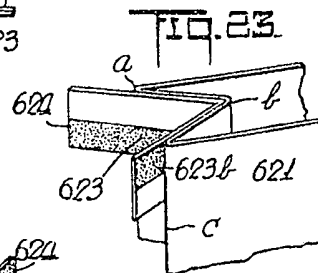
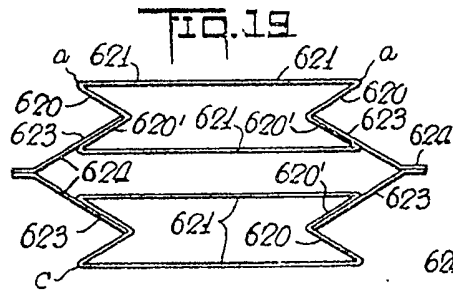
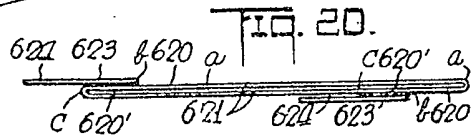
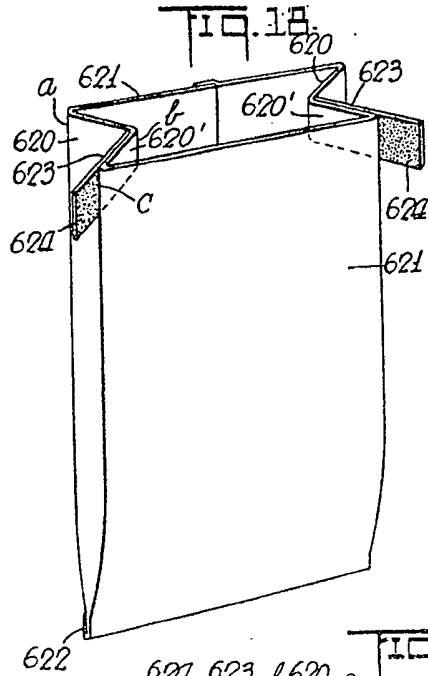


FIG. 22.

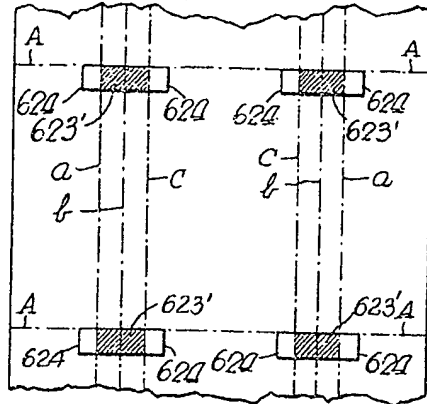


FIG. 24.

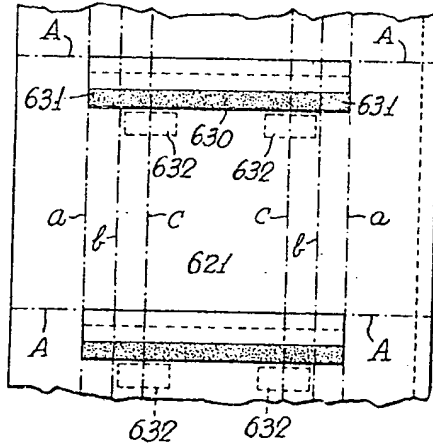


FIG. 28.

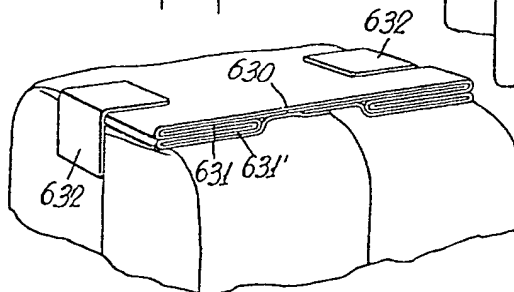


FIG. 26.

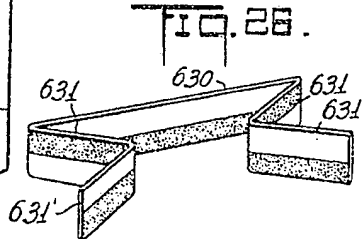


FIG. 27.

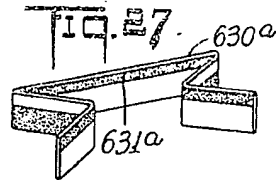


FIG. 25.

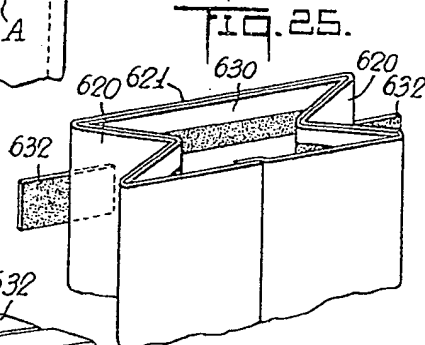




FIG. 29

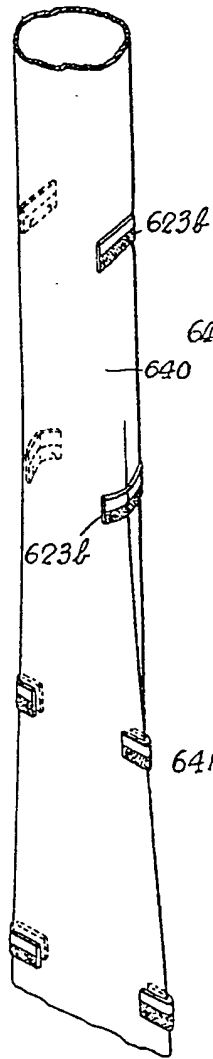
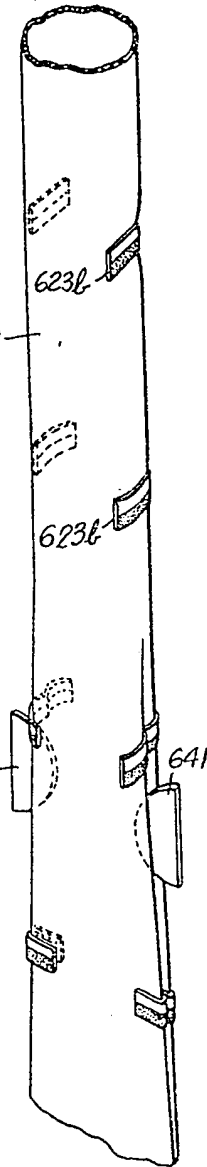


FIG. 30



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FIG. 31.

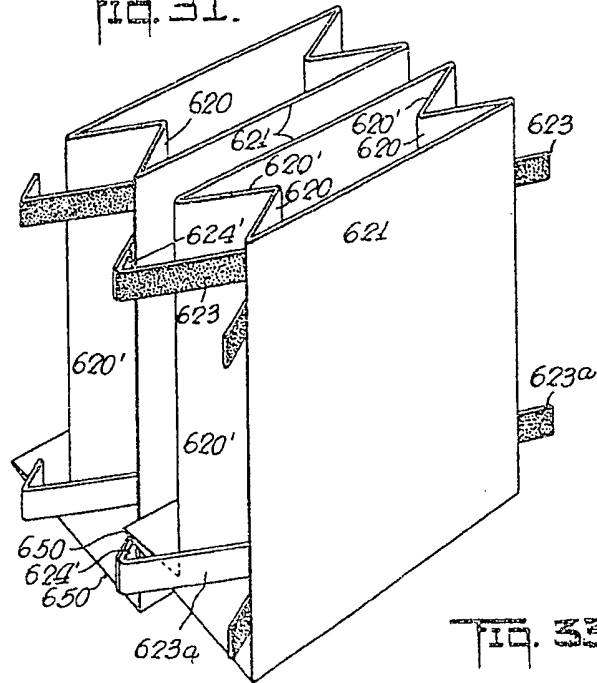


FIG. 32

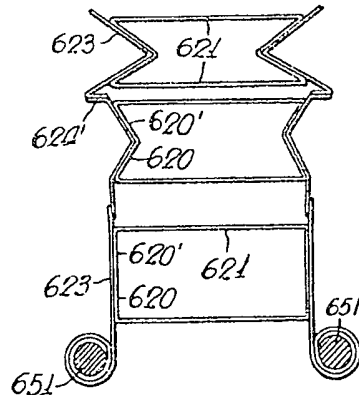
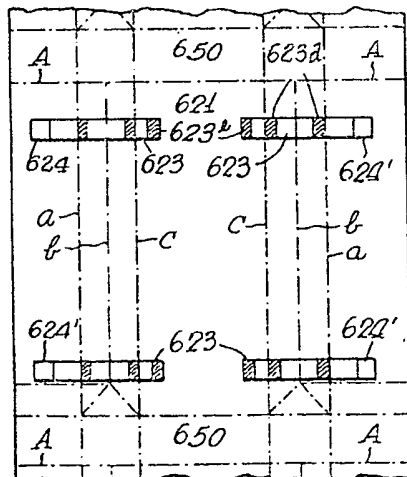


FIG. 33.



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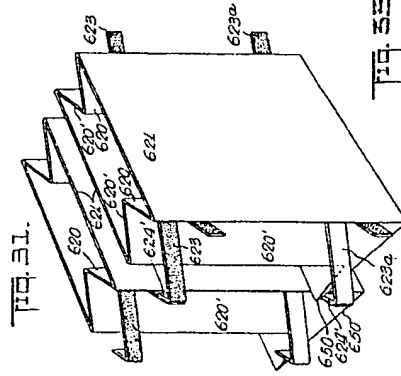


FIG. 31.

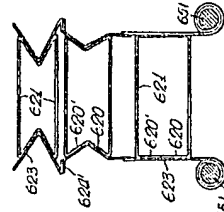


FIG. 32.

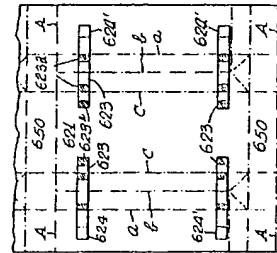


FIG. 33.

FIG. 34.

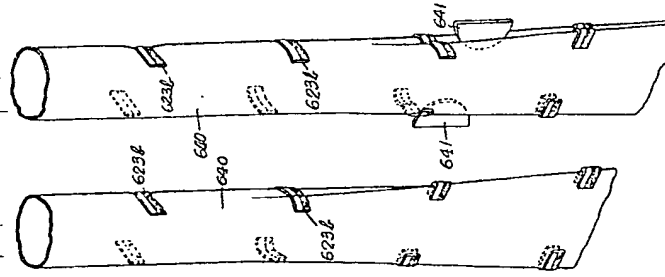


FIG. 35.

Fig. 34.

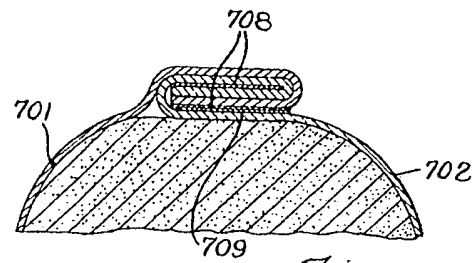
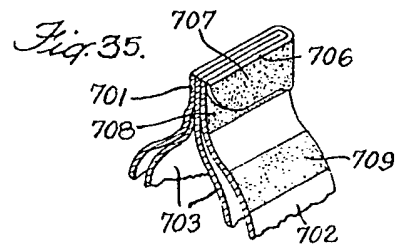
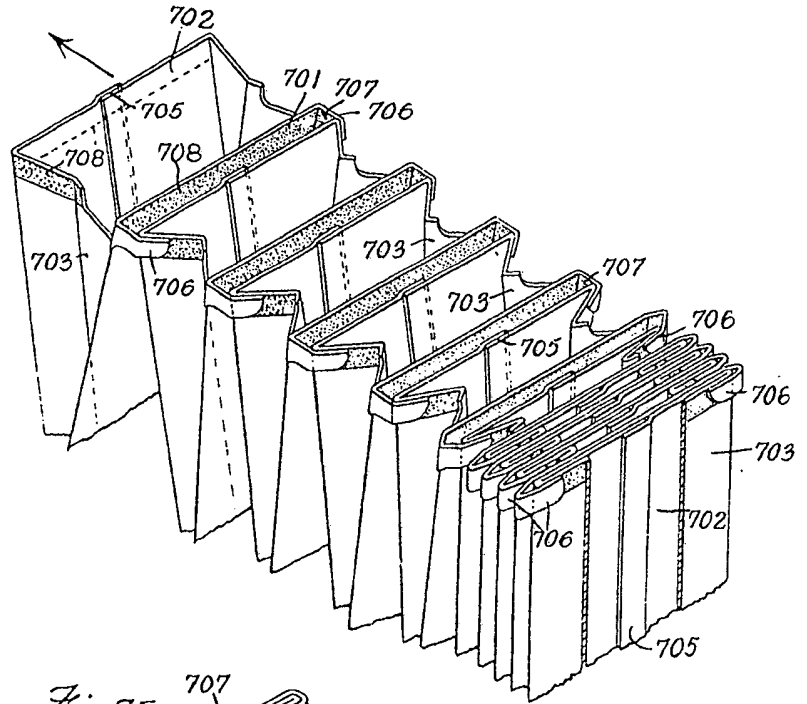


Fig. 36.



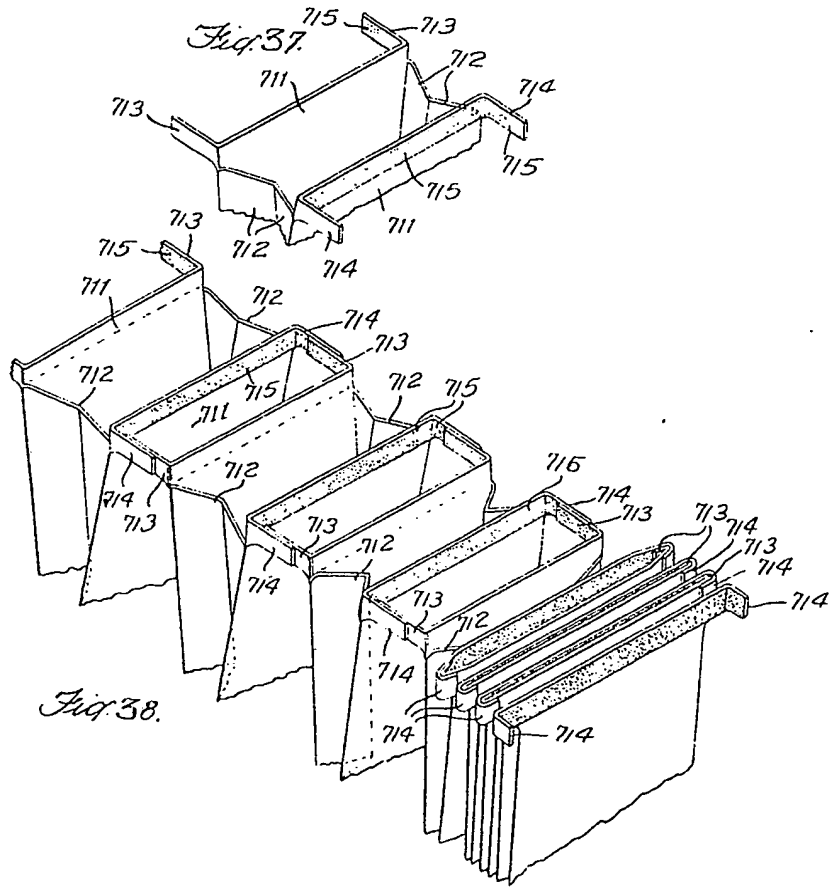


Fig. 34.

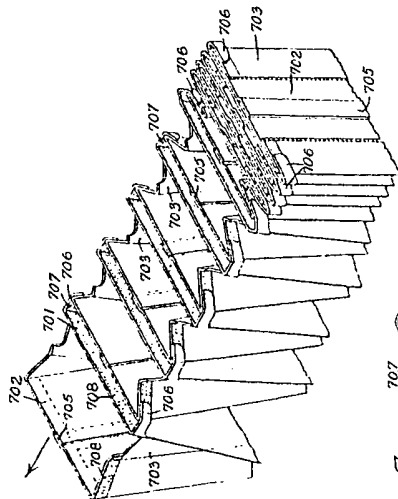


Fig. 35.

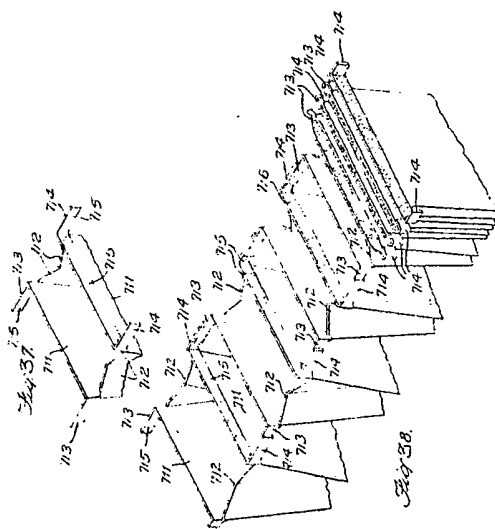
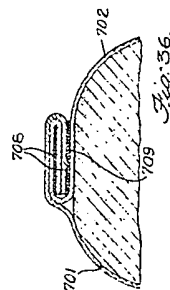
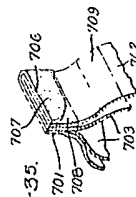


Fig. 38.